COMMONWEALTH AGRICULTURAL BUREAUX

TWENTY-NINTH ANNUAL REPORT

OF THE EXECUTIVE COUNCIL

1957-58

INCLUDING NOTES OF PROGRESS
IN THE AGRICULTURAL SCIENCES

LONDON: HER MAJESTY'S STATIONERY OFFICE
FIVE SHILLINGS NET

COMMONWEALTH AGRICULTURAL BUREAUX
EXECUTIVE COUNCIL

(31st March, 1958)

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A. SHAVITSKY	Australia
V. ARMSTRONG, Ph.D.	New Zealand
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C. E. LAMBERT, C.M.G.	Colonial Territories

SIR HERBERT HOWARD (Secretary)

E. L. HAY, M.B.E. (Assistant Secretary)

(NOTE: Mr. E. J. Drake succeeded Mr. A. Shavitsky as Council member for Australia, after the close of the year).

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PREFACE

The Imperial Agricultural Research Conference, 1927, stressed (*a*) the need for scientists to be in touch with the progress of research throughout the world in their several branches, and (*b*) the difficulty therein owing to the great output of scientific literature and the diversity of languages in which it is published.

It recommended the governments of the British Commonwealth to establish on a joint co-operative basis eight bureaux to collect, collate and disseminate information on research in eight selected branches of agricultural science, and generally to assist research workers in the Commonwealth and Empire with information relevant to their subjects. Each bureau was to be located at a research institute specialising in its own branch of science so that the bureau officers should be in daily contact with men engaged on research in its own subject. These bureaux were to be financed from a common fund contributed by Commonwealth governments in agreed proportions and controlled by a Council composed of representatives of those governments on an equal footing.

Governments accepted these proposals. In November, 1928, a new type of inter-imperial co-operative agency acceptable to all governments was worked out in detail. On 1st April, 1929, the Executive Council of the Imperial Agricultural Bureaux came into being. The eight bureaux started work in that year. From 1st January, 1948, the name of the organisation was changed to Commonwealth Agricultural Bureaux.

Following the Ottawa Conference of 1932, the work of several inter-imperial agencies was examined and reported upon by the Imperial Committee on Economic Consultation and Co-operation (1933). This committee approved of the bureaux organisation and of its work, and extended the duties of the Council, inter alia, proposing that with effect from 1st October, 1933, they should also be responsible for the supervision and administration and finance of the Imperial Institute of Entomology and of the Imperial Mycological Institute.

It also enunciated certain general principles to be observed in regard to the organisation of agencies for inter-imperial co-operation and consultation, e.g., constitutional equality of participating governments in the appointment of the authority administering the work; the provision of adequate finance for a definite period of years; careful and periodical examination of the work and organisation of the agency at the Commonwealth conferences suitable for the purpose, as without that assurance governments could hardly be expected to provide the adequate continuing finance; and the responsibility of the administering authority to all participating governments. All governments accepted this report.

The British Commonwealth Scientific Conference (1936) conducted the first of these "periodical examinations". It approved both the work and organisation. It recommended the finance necessary until 1941-42 (extended later to cover the war period), its distribution between governments, also the formation of two more bureaux, and certain modifications in practice designed to improve general efficiency. Governments accepted these proposals.

A Review Conference was held in the summer of 1946, just one year after the close of the war. This was the first since 1936 and was only the second "periodical examination" since the recommendations of the Imperial Committee on Economic Consultation and Co-operation in 1933. The Review Conference, 1946, recommended that the Parasite Service should continue to be located at Belleville, Canada, that it should become an individual bureau and that its name should be changed to the Bureau (now Institute) of Biological Control to denote its separate entity. It also decided that information on general husbandry should be provided within the framework of the existing bureaux which, in turn, necessitated the name of the Bureau of Pastures and Forage Crops being altered to Pastures and Field Crops. Both changes of name were made on 1st April, 1947, the opening date of the period to which the recommendations of the conference referred. It recommended the finance necessary until 1951-52 and its distribution between governments. Governments accepted these proposals.

The third periodical examination took place in June and July, 1950. With such a well-established organisation as this had now become, the conference was naturally concerned more with consolidation than with new developments. It did, however, lay stress on the need to continue the service; the mutual advantage of co-operation with international bodies, especially to avoid duplication of work; the possibility of foreign governments being associated with C.A.B.; and the desirability of extending the services of the Institute of Biological Control to foreign countries. It also approved the use of Farnham

House for the accommodation of Headquarters and Central Sales, advised the formation of the Consultant Directors into a Scientific Advisory Committee, approved the handing over of the Potato Collection to the Agricultural Research Council of the United Kingdom and provided funds to set up a new Bureau of Agricultural Economics though, for various reasons, the setting up of this bureau was deferred.

A further Review Conference was held in London in the summer of 1955. A section of the report deals with action on the recommendations of this conference but it is worthwhile recording here the opening recommendation:

> "(1) The Conference is firmly persuaded, as a result of the inspections and discussions which have taken place during its progress, that the Commonwealth Agricultural Bureaux Organisation provides an information service on scientific work in agriculture and forestry throughout the world which is of vital importance for agricultural development and thus for the production of food and the maintenance of living standards; that such a comprehensive service is not provided anywhere else and could not be provided by either national or international organisations so cheaply or so efficiently; and that the cost of the service is very small in relation to the value of agricultural and forestry production in the contributing countries.
>
> "The Conference has endeavoured to frame recommendations which will not only ensure the full and efficient maintenance of existing services and provide for some measure of expansion, but will also leave the door open for further enlargement of the field of activities at a later date."

The institutes and bureaux act as effective clearing houses of information for scientists and research workers in agriculture and forestry throughout the Commonwealth and, increasingly, throughout the world.

To do this they collect information by scanning and indexing as far as possible all journals in their subjects in all languages, by scanning other abstracts, and by keeping in touch with research in progress. They distribute this information by the periodical issue of 14 abstract and three other journals, and by the frequent issue of monographs reviewing some particular subject within their field.

Apart from the printed record, the institutes and bureaux serve as intelligence centres in a variety of other ways. They may answer individual enquiries, an activity that ranges from supplying a few references to furnishing a bibliography, a basic library list, or a memorandum of digested information. Several bureaux may co-operate in this, particularly where information marginal to their interest is concerned. They may also supply reprints, photo-reproductions or microfilms of material inaccessible to an enquirer. They also assist research workers by giving information about research centres, by arranging meetings between workers in different parts of the Commonwealth, by arranging the exchange of experimental material between workers, by giving information on post-graduate study, on the sources of supply of apparatus and equipment, and so on. It is stressed that any scientist is free to send enquiries straight to the Director concerned. The institutes have the important additional duty of identification each in its own field.

The Institute of Entomology maintains no collection of its own, as its work is integrated very closely with the British Museum, but the Mycological Institute keeps its own working herbarium which now contains some 72,433 specimens. It also maintains the United Kingdom national collection of type cultures for all fungi except medical fungi, timber rotting fungi and yeasts.

The Institute of Biological Control prepares and maintains a catalogue of the parasites and predators of the insects of the world. Part 4 of Section 2 is the last published. The principal activity of this institute is, however, in the practical field. It consists mainly of the supply of beneficial insects attacking various pests. This requires field survey collections and sometimes mass breeding and the development of special methods of shipment. There are substations in Europe, India, Pakistan, West Indies and the United States. In addition to the supply of parasite material, the institute takes complete charge of biological control projects for governments. The institute also carries out research and educational work.

A brief summary of the work carried out at the institutes and bureaux during the year under review is given on pages 15-26.

The organisations under the administration of the Executive Council are:

The Commonwealth Institute of Entomology
The Commonwealth Mycological Institute
The Commonwealth Institute of Biological Control
The Commonwealth Bureaux of:
- Animal Breeding and Genetics
- Animal Health
- Animal Nutrition
- Dairy Science and Technology
- Forestry
- Helminthology
- Horticulture and Plantation Crops

Pastures and Field Crops
Plant Breeding and Genetics
Soils

A 'liaison' officer appointed by the appropriate department of each participating country keeps in touch with administrative matters, and in each country for each bureau a scientific officer is nominated as Official Correspondent to be the 'general friend' on scientific matters of that bureau in that country. The heads of the several institutes at which bureaux are located act as Consultant Directors of the bureaux, thus giving the Council and bureaux the benefit of their wide experience and scientific knowledge. Together they constitute the Scientific Advisory Committee. All other officers are whole-time servants of the Executive Council.

REPORT

At its meeting on the 23rd July, 1958, the Executive Council of the Commonwealth Agricultural Bureaux adopted the following report on its 29th year of work—1st April, 1957, to 31st March, 1958.

This is the first financial year of the review period 1957-58 to 1961-62.

GENERAL NEWS

2. *Ghana and Malaya.* The Government of Ghana, which became an independent State within the Commonwealth on 6th March, 1957, accepted the invitation of the Executive Council to continue its association with the Commonwealth Agricultural Bureaux.

An invitation was also extended to the Government of the Federation of Malaya, which achieved independent status on 31st August, 1957, to continue its membership of C.A.B.

3. *Council meetings.* These were held, as usual, at Africa House and also at Farnham House, at the Bureau of Horticulture and Plantation Crops, East Malling, and at the Bureau of Animal Health, Weybridge. Council met seven times during the year besides their conferences with the Scientific Advisory Committee and with Directors.

4. *Recognitions and awards.* Dr. E. Marsden, who represented New Zealand on the Executive Council and was Chairman from January, 1953 to March, 1954, had the honour of a knighthood conferred on him in the New Year Honours 1958.

Dr. D. P. Cuthbertson, Consultant Director of the Bureau of Animal Nutrition, received a C.B.E. in the 1957 Birthday Honours List.

Dr. P. S. Hudson, Director, Bureau of Plant Breeding and Genetics, was awarded an O.B.E.

Dr. W. R. Thompson, Director, Institute of Biological Control, was elected an Honorary Member of the Royal Irish Academy in March, 1958. He was also appointed editor of the *Canadian Entomologist* for 1958.

Mr. E. O. Pearson, Director-Designate, Institute of Entomology, was elected to the Council of the Royal Entomological Society of London in February, 1958.

Mr. J. P. Maule, Director, Bureau of Animal Breeding and Genetics, was elected a Fellow of the Royal Society of Edinburgh on 3rd March, 1958.

Professor R. T. Leiper, Director, Bureau of Helminthology, was elected an Honorary Member of the American Society of Parasitologists (at their annual meeting in November, 1957) "as a person who has attained exceptional distinction in parasitology".

5. *Location.* For many years efforts have been made to move the European sub-station of the Institute of Biological Control to a more suitable place than Zurich. The place finally chosen was Delemont. From the point of view of work it was an excellent choice.

The town of Delemont is on a main railway line and is situated just south of Basle, which has an airport, a large University with departments of Botany, Entomology and Zoology and good entomological collections. The forest comes to within a couple of miles of the town of Delemont and consists of miles of forest-covered hills of spruce and silver fir pure or mixed with large patches of beech, Scots pine mixed with beech, sometimes all four in mixture and various subsidiary species. The forest is almost all of the selection type with excellent regeneration of all species in groups of various sizes and ages. It is as near a natural forest as any properly managed forest is likely to be and forms a variable collecting ground with excellent opportunities for studying the parasites in relation to the general ecology.

The European staff moved from the laboratory in Feldmeilen (a suburb of Zurich) to the much more commodious laboratory in Delemont in March, 1958.

The small laboratory in the town of Mendrisio, in the Canton of Tessin, maintained for work on Australian and New Zealand projects since the middle of 1955, was closed in the autumn of 1957, as it was considered more advantageous to have the staff working together and the laboratory in Delemont provided ample room.

6. *Appreciations.* An Australian subscriber, in advising a Canadian to take *Animal Breeding Abstracts*, characterised it as "one of the best in its field".

A distinguished professor stated that the indexes to the first 15 volumes of *Plant Breeding Abstracts* were "the best thing he knows".

Articles appearing in some continental journals now quote many of the references in the bibliographies by citing *Plant Breeding Abstracts* only (that is without reference to the original) e.g. *Züchter 27:* p. 139 and *Rivista della Ortofloro-frutticoltura Italiana* 1957: *41* 619-24.

7. *Lectures.* Sir Herbert Howard's lecture tour in the United States in the autumn of 1957 had to be cancelled owing to influenza at the wrong moment.

On the 18th March, 1958, Sir Herbert presided at a meeting arranged by the Commonwealth Section of the Royal Society of Arts at which a paper on "The Pastoral Industry of Australia" was read by Mr. F. W. Bulcock, Agricultural Counsellor for Australia in London.

At the invitation of the Universities of Exeter and London, respectively, Dr. J. C. F. Hopkins delivered lectures to botanical students and participated in the post-graduate seminar on "Science in the New Commonwealth Countries" at the Institute of Commonwealth Studies.

At the Hertfordshire Special Libraries Group half-yearly meeting at the Bureau of Helminthology, Professor R. T. Leiper, the Director, gave a short account of the work of the bureau and of the C.A.B. Organisation and exhibited a number of early and rare works on helminthology.

Dr. P. S. Hudson gave a lecture on the "Commonwealth Agricultural Bureaux" to Colonial Agricultural Probationers on 8th August, 1957.

His Assistant Director, Mr. R. H. Richens, gave a lecture on Machine Translation to the University of Cambridge Philosophy of Science Group on 24th February, 1958.

Mr. Richens, in conjunction with Mr. M. A. K. Halliday, wrote a paper entitled "Word Decomposition for Machine Translation" which was presented to the 8th Annual Round Table Meeting on Linguistics and Language Studies held in Georgetown University, U.S.A., April 12-13, 1957.

8. *Coverage.* Increasing attention is being paid to literature in the more difficult languages, such as Russian, Chinese and Japanese.

The Bureau of Plant Breeding and Genetics claims that the only serious gap in the coverage of its journal has been made good now that some five additional journals from China are being received and abstracted.

With the valuable assistance of the new Russian section of the D.S.I.R. lending library, an increase of 13 regular journals has been made to the coverage of the *Review of Applied Mycology* and two of the *Review of Medical and Veterinary Mycology.* Access was obtained to 17 volumes of regional floras of the U.S.S.R., from 1931-57, none of which had previously been seen. These contained many descriptions of fungi, a number of which are new species, the latter being a valuable addition to the *Index of Fungi.* Personal contact was also made with professors of plant pathology or their administrative representatives in Bulgaria, Czechoslovakia, Estonia, and two academic centres in Poland. Literature exchanges have been or are being arranged with these institutions, thus tapping a source of information that has never been accessible before and has provided the Mycological Institute with nearly 100 abstracts since the beginning of 1958.

The feature of the year at the Bureau of Soils has been the further increase in the number of abstracts made and papers indexed, but by careful selection there has been no increase in the number of abstracts printed or in the size of the journal. It is estimated that within the last 10 years the annual number of abstracts made at the Bureau has increased by 125%. There has been some increase too in the amount of translation done by the staff which in general welcomes this kind of work as a relief from abstracting.

The procedure of "mechanizing" answers to enquiries by providing annotated bibliographies from the card index has been continued by the Bureau of Soils. Of the 109 enquiries received by that bureau, 76 were answered by providing bibliographies. An enquiry on cotton fertilizing from the U.S.A. (for which, coming from a non-contributing country, a charge was made) provided a good illustration of the speed with which an annotated bibliography could be prepared. The collection, sorting and checking of 359 references and abstracts occupied one skilled assistant for one day only, although the typing required much more labour. There is a continuous demand for bibliographies, and in the last quarter of the year rather more than £30 was obtained for those sold by the Bureau of Soils, over and above the free distribution.

9. *Oxford Decimal System of Classification for Forestry.* After several years of negotiation between the Forestry Bureau and the Central Classification Committee of the International Federation for Documentation via the British Standards Institution, an accord for the incorporation of the system into the U.D.C. was at length reached and came into force with effect from July, 1957.

The German authorized edition has now been published but the French has suffered various delays, and the Spanish is still under bureau scrutiny. Dutch, Czech, Turkish and (abridged) Finnish versions have also reached the bureau. Several weeks of special training in the use of the classification were given to Messrs. Lückhoff

(Research Officer, Silvicultural and Hydrological Research Branch, Pretoria, South Africa) and Hjeltnes (Librarian, Forest Research Institute of Norway, Vollebekk).

The growing use of the Oxford Decimal System in the United States is illustrated by the Logging Division of the influential Forest Products Research Society adopting it for a classified bibliography on logging.

10. *Information Services.* The standard of the existing information service was maintained and ways and means considered of providing further services to contributing countries.

Of the 781 enquiries from the Bureaux, 635 were from Commonwealth or associated countries and 146 were from foreign countries.

A drop in the number of enquiries (890 to 781) from the figures reported by directors in 1956-57 does not give cause for alarm because

(*a*) clients are undoubtedly making more use of the very full and promptly issued indexes of the bureaux journals together with the journals themselves to obtain quick answers to many of the enquiries which previously they would themselves have sent to the bureaux;

(*b*) clients are becoming increasingly aware of the general availability of replies sent in answer to enquiries, and are demanding and receiving copies of these replies. This undoubtedly eliminates many further enquiries.

Among the more interesting subjects on which information was sought were the following:

Fur-bearing animals. There would appear to be an increasing interest in the breeding of fur-bearing animals in Great Britain and three requests for information on the diseases of these animals were received by the Bureau of Animal Health. They concerned the parasites of mink, skin diseases of chinchillas and diseases of mink.

Agalactia in sows. In this condition, after the birth of an apparently normal litter of pigs, losses occur because the sow fails to produce milk. In some cases the failure to produce milk seems to be a consequence of a specific bacterial infection either of the uterus or the udder but in others the sow is to all appearances in good health, the only observable abnormality being the failure to come into lactation. The condition seems to be becoming more common of late and two enquiries, one from Rhodesia, were received. Such information as is available was supplied but there is obviously a lack of precise knowledge of causation and of prophylactic or curative treatment.

Life span of erythrocytes in animals. New techniques have been developed in recent years for estimation of this. These new techniques involve the use of radio-active isotopes and more precise knowledge is now available.

Tortoises and anthrax. A rather unusual enquiry concerned the possibility of anthrax being introduced by imported tortoises. This enquiry originated in Mauritius and came to the bureau *via* the Zoological Society. A search of the literature failed to uncover any information on the length of time that anthrax organisms would remain viable in the intestinal tract of tortoises but information concerning other cold-blooded species, such as various lizards, was supplied.

Weed Control. The Bureau of Horticulture and Plantation Crops was asked about the eradication or control of the water hyacinth, whose blue flowers grace, and whose stems eventually block, miles of tropical waterways.

Classics. A fascinating, but not very utilitarian, enquiry: was there anywhere either in Punic or in translation a copy of the works of Mago, the Carthaginian, who lived 2,000 years ago and whose works were brought to Rome after the sack of Carthage and were much quoted by Pliny and other Latin authors when dealing with agricultural problems? Erudite Germans have quoted the Latin writers but the originals and translations appear to have vanished.

Professor Leiper supplied information on the qualifications of applicants for appointments, postgraduate Fellowships, grants, etc., to the National Research Council of Canada, the Commonwealth University Interchange Committee of the British Council, the Australian Scientific Liaison Office, London, and the Association of Universities of the British Commonwealth.

RECOMMENDATIONS OF THE 1955 REVIEW CONFERENCE

11. The following action has been taken on the recommendations of the 1955 Review Conference. Only those recommendations are included here on which some action has been taken during the year under report. At the same time, action continues on the various recommendations mentioned in last year's report, but they are not repeated here unless there has been some fresh action. For economy, the recommendations themselves are not printed, but the references are to the recommendation numbers given in paragraph 21 of the 1955 Review Conference Report.

Recommendation (2). This is kept under biennial review.

Recommendation (3). The Executive Council are fulfilling this recommendation by holding alternate meetings at Africa House and at an institute or bureau so far as this is possible.

Recommendation (4). The Bureau of Plant Breeding and Genetics supplied F.A.O. with information on the varieties of cowpea resistant to curculio.

Mr. G. V. Jacks, Director, Bureau of Soils, was seconded to F.A.O. for about 7 weeks from 25th November, 1957, to initiate a project entitled "The soil resources of the world".

F.A.O. consulted C.A.B. on the efficiency in publication of the results of agricultural research.

Recommendation (6). The Institute of Biological Control maintained relations during part of the year with the International Commission of Biological Control through Dr. L. P. Mesnil as Assistant Director of the Identification Service and Dr. V. Delucchi as Secretary of that Service.

Recommendation (8)(*b*). It has been reported that the Official Correspondents for India and the Federation of Rhodesia and Nyasaland have visited some of the bureaux.

Recommendation (8)(*d*). During the VIIth British Commonwealth Forestry Conference, which was attended by 78 delegates from 18 countries, the Director of the Forestry Bureau took the opportunity to meet his Official Correspondents collectively and to discuss with them problems of mutual concern at Forestry House, Canberra, on the 18th September, 1957.

Recommendation (13). Following the example of the Agricultural Research Council, the Executive Council have introduced an Increase in Pensions Scheme for all C.A.B. staff retiring after the age of 60 years. This is a separate scheme from supplementation of superannuation referred to last year.

Recommendation (17). This is to be discussed at the 1960 Review Conference.

Recommendation (22)(*a*). Arrangements are in hand for the preparation of the next List of Research Workers.

Recommendation (24)(*b*). The present Annual Report contains "Notes of Progress" in Biological Control, Dairy Science, Helminthology and Horticulture.

Recommendation (27). The arrangements for the exchange of abstracts on weed control are being continued.

Recommendation (28). This is current practice.

Recommendation (35)(*a*). Materials on the Nematoda are being assembled.

Recommendation (35)(*b*). As no suitably qualified person has yet become available for appointment as taxonomist, requests for identifications have been met by the Director with the assistance of outside specialists.

Recommendation (35)(*c*). Not yet begun.

Recommendation (35)(*d*). Bibliographical help was given for an Eelworm survey of Mauritius.

Recommendation (45) is kept under biennial review.

Recommendation (48). Some interest has been aroused outside the Commonwealth in the proposal for the establishment of a Bureau of Agricultural Economics. With the aid of a grant from the Council of Economic and Cultural Affairs Inc. of New York, the International Association of Agricultural Librarians and Documentalists has undertaken the compilation of a sample issue of an abstract journal in the field of agricultural economics.

Recommendation (55). As a result of various investments made, the interest and discount that accrued during 1957-58, from the Bureaux Fund alone, amounted to approximately £3,820.

MEMBERSHIP OF THE EXECUTIVE COUNCIL

12. The Executive Council agreed that a convenient time to change the yearly Chairmanship was during the summer break in meetings, that is, the existing incumbent should remain Chairman up to the end of the summer break and the new Chairman take over from the first meeting in October.

Mr. Swaminathan was elected Chairman-designate at the 165th meeting on 29th July, 1957, and took the chair from the 166th meeting on 3rd October, 1957. Dr. J. G. Malloch succeeded Mr. Swaminathan as Vice-Chairman.

The Lord Privy Seal, on behalf of the Prime Minister, appointed Mr. W. G. Alexander, C.B.E., as the representative of Great Britain and Northern Ireland on the Executive Council in succession to Mr. W. C. Tame.

Mr. E. D. Andrews, who had deputised for two years as Council member for the Union of South

Africa was, on his appointment as Senior Trade Commissioner, nominated as the Union's representative on the Executive Council.

Mr. A. Perera was nominated Council member for Ceylon, and Mr. C. K. Reheem as Council member for Pakistan.

Mr. K. B. Asante was welcomed as the first representative of Ghana to serve on the Executive Council.

Mr. Frank Lidgett McDougall, one of the founders of F.A.O., died peacefully at the Salvator Mundi Hospital in Rome on the morning of 15th February, 1958. Mr. McDougall was member of Council for Australia for 17 years, from 1929 to 1946, the longest in the history of C.A.B., and served as Chairman from July, 1931 to January, 1934.

LIAISON OFFICERS

13. Dr. P. W. Vorster, on his promotion to Director of Technical Services, continued as Liaison Officer for the Union of South Africa.

The Permanent Secretary, Ministry of Agriculture, Accra, was nominated Liaison Officer for Ghana.

Mr. C. D. Ryan took over as Liaison Officer for the Republic of Ireland in place of Mr. S. M. Breathnach.

STAFF CHANGES

14. *Consultant Directors.* Sir Joseph B. Hutchinson, C.M.G., Sc.D., F.R.S., Drapers' Professor of Agriculture, University of Cambridge, was appointed Consultant Director to the Bureau of Plant Breeding and Genetics on the retirement of Sir Frank L. Engledow in September, 1957.

The impending retirement of Sir William Ogg and Professor H. D. Kay is noted with regret.

Directors. Mr. E. O. Pearson was appointed Director-designate to succeed Dr. W. J. Hall at the Institute of Entomology.

Mr. E. J. Mann, Assistant Director, was appointed Director, Bureau of Dairy Science and Technology, in place of Mr. A. W. Marsden who resigned in July, 1957 to become General Secretary of the International Dairy Congress to be held in London, June/July, 1959.

VISITS OVERSEAS

15. Dr. W. J. Hall, Director, Institute of Entomology, visited the Republic of the Sudan from 7th-22nd January, 1958, as a member of the Advisory Committee on Agricultural Research in the Sudan.

Mr. E. A. J. Duffy returned in the middle of June, 1957 after spending three months in Trinidad and British Guiana to obtain further material for the next volume of his series of monographs on the immature stages of timber bettles.

At the invitation of the Colonial Office, Dr. J. C. F. Hopkins, Director, Mycological Institute, toured Agricultural Research Stations in East African territories in October and November, 1957, and visited Zanzibar to assess the danger of withertip disease of limes. In February, 1958 he visited tea and coffee estates in Kenya to discuss the problems of *Armillaria mellea* root rot in forests and tea, and of coffee stem diseases.

Dr. Wheeler went to Zanzibar in February, 1958 to commence an investigation of withertip disease of limes for the Pool of Plant Pathologists.

On his way to the VIIth British Commonwealth Forestry Conference, Mr. F. C. Ford Robertson, Director, Forestry Bureau, made short tours in Kenya, Uganda, Tanganyika and the Union of South Africa, and on his return journey visited Fiji and the University of British Columbia.

It is a general rule that reports are submitted to Council on all tours made and conferences attended in overseas countries.

ATTENDANCE AT CONFERENCES AND COMMITTEES

16. Dr. W. J. Hall and Dr. J. C. F. Hopkins attended the meeting of the Inter-African Phyto-sanitary Commission held in London on 18th and 19th September.

Dr. Hall continued as Chairman of the Colonial Pesticides Committee and also as a member of the Colonial Research Council, the Committee for Colonial Agricultural, Animal Health and Forestry Research, the British Standards Institution Technical Committee on Nomenclature of Pesticides, the Advisory Committee on Anti-Locust Research and other Committees or Sub-Committees dealing directly or indirectly with entomological problems overseas.

Mr. E. O. Pearson was elected to the Council of the Royal Entomological Society of London in February, 1958, and Captain H. S. Bushell continued to serve as a member of the Abstracting Services Consultative Committee of the Royal Society.

Dr. J. C. F. Hopkins continued to serve on the Colonial Agricultural Research Committee, Colonial Pesticides Research Committee, British Standards Institution Pesticides Committee, London Advisory Council for Rubber Research, and the Medical Mycology sub-committee of the Medical Research Council. He also represented the Secretary of State for the Colonies on the East African Agricultural Research Council at meetings in November, 1957 and February, 1958 at the invitation of the Colonial Office. He was elected to the Council of the British Mycological Society in December, 1957.

Major Dade continued to serve on the Stored Products sub-committee of the Colonial Agricultural Research Committee.

Dr. W. R. Thompson, Director, Institute of Biological Control, continued to act as President of the Xth International Congress of Entomology. These duties will end with the publication of the Proceedings of the Congress, which are now being printed. Dr. Thompson has had consultations with the Secretary of the International Congresses as the Canadian representative on the Permanent Committee.

Mr. M. Crawford, Director, Bureau of Animal Health, attended the Medical Research Council Mycology Conference in April, 1957 and the Association of Veterinary Research Workers and Teachers' Conference at Bristol in July, 1957.

The British Veterinary Association Congress at Cambridge, August 26-31, 1957, was attended by Mr. Mack.

Dr. I. Leitch, Director, Bureau of Animal Nutrition, and her Assistant Director, Dr. D. Harvey, attended the IVth International Congress of Nutrition in Paris, 26th July to 1st August, 1957.

Dr. D. L. Duncan was granted leave of absence for one month spent in Jugoslavia. The visit was at the invitation of the Director of the Institute of Hygiene, Belgrade, and she saw the work undertaken in different parts of the country on pellagra.

Mr. E. J. Mann, Director, Bureau of Dairy Science and Technology, has been appointed a member of one of the Committees helping to organize the XVth International Dairy Congress to be held in London in June-July, 1959.

Mr. Ford Robertson attended the VIIth British Commonwealth Forestry Conference held in Australia and New Zealand from 22nd August to 8th October, 1957, a meeting of the Standing Committee on British Commonwealth Forestry and the annual meeting of the Empire Forestry Association.

The Director of the Bureau of Pastures and Field Crops, Mr. A. G. G. Hill, attended the meeting of the organizing committee of the VIIIth International Grassland Congress, 1960.

Dr. P. Hudson, Director, Bureau of Plant Breeding and Genetics, attended the International Symposium of the Societa Italiana per il Progresso della Zootecnica, Milan, 22nd-25th April, 1957, the Conference on Collections of Crop Plants and their Systematics held in Gatersleben, E. Germany, 23rd-25th, 1957, and the International Commission for the Nomenclature of Cultivated Plants held in London, 4th-6th December, 1957. At the request of the Agricultural Research Council, he also visited research stations in Federal Germany and the German Democratic Republic to study work in progress there on the artificial induction of useful mutants in crop plants.

Dr. Hall, Dr. Hopkins, and Mr. Argles attended the IXth Conference of the Cocoa, Chocolate and Confectionery Alliance Ltd., held in London from 10th-12th September, 1957.

VISITS TO INSTITUTES AND BUREAUX BY DISTINGUISHED SCIENTISTS

17. Among many distinguished scientists who visited the Institutes and Bureaux, the following are taken at random:

Dr. E. D. C. Baptiste, Ceylon; Professor S. Barbacki, Poznan Institute of Plant Breeding, Poland; Dr. G. R. Bates, Southern Rhodesia; Mr. H. R. Binns, East African Veterinary Research Organisation, Kenya; Dr. J. N. Black, Waite Agricultural Research Institute, University of Adelaide, Australia; Professor A. S. Boughey,

Southern Rhodesia; Dr. H. Clepper, Society of American Foresters; G. O'H. Giles, South Australia; Dr. A. Gortner, Netherlands; Prof. F. E. Kolyasev, Agrophysical Institute, Leningrad; Eng. S. Lopes, Direccao Geral dos Servicos Florestais e Agricolas, Lisbon, Portugal; Mr. L. W. Martin, New South Wales; Dr. C. P. McMeekan, Ruakura Animal Research Station, New Zealand; Dr. M. L. d'Oliveira, Portugal; Professor E. Pap, Hungary; Dr. D. Prasad, India; Professor A. Rayss, Jerusalem; Professor W. P. Rogers, Australia; Professor S. W. Terrill, Urbana, U.S.A.; Professor A. Thompson, Singapore; Dr. R. W. Touchberry, University of Illinois, U.S.A.; Dr. J. R. Vickery, Commonwealth Scientific and Industrial Research Organisation, Australia; Professor J. M. Watson, Iraq; Dr. J. W. Wilson, Los Angeles; Dr. M. G. Weiss, Plant Breeding Station, Beltsville, Maryland, U.S.A.

Two people from the Overseas Service spent short periods in the Bureau of Animal Breeding and Genetics during their leave: one was from the Northern Region of Nigeria, the other from Sierra Leone. Both of them were able to meet and discuss problems with research workers in Edinburgh. Visits to research organisations were arranged for three other overseas visitors.

A party of veterinarians from a number of research laboratories in Europe who attended a course on diseases of poultry at the Weybridge Laboratory under the auspices of the British Council were able to see something of the Bureau of Animal Health and of its working.

Mr. John Hare, Minister for Agriculture, Fisheries and Food, spent a short time in the bureau in the course of a very busy morning when he visited the Veterinary Laboratory on 31st January, 1958.

On the return of Mr. Ford Robertson from abroad, he gave a special tutorial to three Asian graduates. The Institute staff were also addressed on bureau activities on 24th May, 1957.

Professor J. Unrau, of the University of Alberta, Canada, worked in the library at the School of Agriculture in December, 1957 and Mr. Hemingway of Colemans Ltd. worked in the library from 1st-8th March, 1958.

Finally, H.R.H. Prince Philip, the Duke of Edinburgh, during an official visit to East Malling Research Station, discussed and showed interest in bureau work.

PUBLICATIONS

18. The receipts from sales of publications have always been collected separately by the institutes for their respective publications, and by the Bureau of Animal Nutrition for the journal *Nutrition Abstracts and Reviews*. Central Sales deals with the sales of publications for headquarters, for all the bureaux and for the Occasional Publications of the Bureau of Animal Nutrition. The four sets of cash have always been shown separately in annual reports.

19. In addition, in reports before 1953-54, the cash receipts of Central Sales were analysed for headquarters and for each separate bureau. This analysis entailed a considerable amount of work and some thought its value was doubtful as it did not represent the value of sales made during the year. Council therefore decided that, as from the 1st April, 1953, this cash analysis should be discontinued and the receipts of Central Sales during the financial year should be shown as a block total, the figure for 1957-58 being £45,018 as against the 1956-57 figure of £40,868 (see paragraph 20). Council also thought that instead of a cash analysis a record of invoices sent out during the year should be made showing the value of the actual sales made during the year. From paragraph 22, it will be seen that the figure for 1957-58 is £44,394 as against the 1956-57 figure of £42,094.

20. Receipts from sales of publications over the last seven years have been as follows:

	1951–52	1952–53	1953–54	1954–55	1955–56	1956–57	1957–58
	£	£	£	£	£	£	£
Commonwealth Institute of Entomology	10,060	9,402	10,210	10,334	11,433	15,582	14,144
Commonweath Mycological Institute	5,228	5,639	7,367	6,833	6,820	9,438	10,781
Nutrition Abstracts and Reviews	4,723	3,505	7,031	6,972	8,428	9,928	9,582
The Bureaux	16,156	23,932	27,100	30,252	31,041	40,868	45,018
TOTAL	36,167	42,478	51,708	54,391	57,722	75,816	79,525

NOTE 1: The prices of journals were raised for the 1953 and 1957 volumes.

NOTE 2: The decrease in receipts for Entomology was largely owing to a decrease in the demand for back volumes—a demand which is very likely to fluctuate.

Receipts from sales of *Nutrition Abstracts and Reviews* rose in 1957-58 but total income was less than in 1956-57, the year in which the 2nd Quinquennial Index was published and the demand for it largely satisfied. Without it the Journal income for the last two years has been £9,084 and £9,535. Expenditure on printing, distribution and paper for the bureaux (excluding *Nutrition Abstracts and Reviews* and the Institutes) amounted to £32,364 during the year as against £32,501 for the preceding year. Cash collected during the year was £45,018, thus giving a surplus of £12,654 of revenue over expenditure. This surplus is due partly to the increased annual subscription rates introduced on 1st January, 1957 and partly to an overall rise of subscribers of 7·1% for the bureaux journals (12 journals including Index Veterinarius and Veterinary Reviews and Annotations) published in the year 1957 as against the subscribers for the year 1956. It must be repeated that only journals dealt with at headquarters are included in this calculation, that is, excluding Entomology, Mycology and Animal Nutrition. The rise in revenue of £4,150 is not only due to the increases in subscribers and prices but also to a continuing demand for back volumes of the journals and for occasional publications.

21. *Reprinting Unit.* The increased and continuing demand for back volumes of the abstract journals has already been mentioned. Many of the volumes in demand were out of print and it was often not possible to supply them and more particularly to supply complete sets. To have had these reprinted commercially, even by photo-lithography, would have meant a very high cost per copy. Where cheaper estimates for reprinting were obtained, the printers would not give any date for delivery of the completed work and this would have meant delay in obtaining the necessary reprints. The Executive Council, after an investigation of different methods of reproduction, sanctioned the establishment of a small reprinting unit at Farnham House, this unit to reproduce back volumes using Xerography (an electrical reproduction process for making paper and metal offset duplicating masters) and offset litho equipment. The unit commenced to operate in November, 1957, and has, by reproducing quickly the back volumes out of print at a reasonable cost, increased receipts from sales for back volumes. It is too early to report fully how extensively this method can be used but it looks as if this unit, under the direct control of C.A.B., may solve a number of problems.

22. The sales analysis, that is, the analysis of the actual invoices sent out during the year referred to in paragraph 19 above, is shown in the table below. For comparison, figures are given for seven years: two years' cash analysis and five years' sales analysis. It is clear, therefore, that the last five columns are comparable only with each other and are not strictly comparable with the preceding two columns of cash analysis. Only the publications dealt with by Central Sales have been shown in this way and the earlier figures are intended to show the general trend.

	Cash Analysis		Sales Analysis				
	1951–52	1952–53	1953–54	1954–55	1955–56	1956–57	1957–58
	£	£	£	£	£	£	£
Animal Breeding and Genetics	1,485	2,712	2,661	2,934	2,625	3,145	3,706
Animal Health	2,404	4,481	4,161	5,014	5,781	6,963	8,108
Animal Nutrition	40	61	83	51	41	628	513
Dairy Science and Technology	1,664	1,764	2,101	2,388	2,727	5,107	3,972
Forestry	2,193	2,290	2,442	2,939	3,274	5,180	5,087
Helminthology	1,129	1,203	1,540	1,621	1,866	2,266	3,174
Horticulture and Plantation Crops	1,755	2,720	3,729	3,343	3,541	4,686	5,036
Pastures and Field Crops	1,953	3,155	3,033	4,083	3,916	4,787	4,830
Plant Breeding and Genetics	1,370	2,450	2,911	2,929	3,718	4,320	4,242
Soils	2,089	2,908	2,822	3,648	4,005	4,683	5,468
Headquarters	74	188	184	106	88	329	258
TOTAL	16,156	23,932	25,667	29,056	31,582	42,094	44,394

The decrease in receipts from sales of the publications of the Bureau of Dairy Science and Technology from £5,107 in 1956/57 to £3,972 in 1957 was due to (i) no occasional publications having been produced during 1957/58 whereas one was produced in each of the two preceding years, and (ii) a fall in receipts from advertisements in *Dairy Science Abstracts*. During 1956/57, one number of *Dairy Science Abstracts* was given wide circulation at the XIVth International Dairy Congress, Rome, and this number attracted many advertisements. This revenue, being occasional, was not repeated in 1957/58.

23. The above table relates to sales and takes no account of copies distributed under the quota system or free. Under the quota system copies of the

1957 volumes of the journals to the value of £8,576 were sent to countries of the Commonwealth and other contributing countries. In addition, journals to the value of £2,279 were sent free or as exchange to Commonwealth countries and to the value of £3,273 to foreign countries.

The total value of copies distributed under the quota, free and exchange was £14,128.

Corresponding figures for 1956 were quota £7,211, free and exchange to Commonwealth countries £1,667 and to foreign countries £2,782; total value £11,660.

In paragraph 20 it is said that receipts from sales during the year showed an excess over the direct costs of printing, distribution and paper, but if the very great value of these various free copies is added to the receipts, the total comes to far more than the direct cost of production.

24. In addition, a further 187 volumes of *Agricultural and Horticultural Engineering Abstracts* were distributed under the quota system by arrangement with the National Institute of Agricultural Engineering.

25. The numbers on the mailing lists for the 1957 volumes of all the journals were as follows:

	Volumes supplied under quota system	Other volumes supplied free	Subscriptions	Total
British Commonwealth, the Republic of Ireland and the Republic of the Sudan	2,655	706	6,324	9,685
Other countries	—	1,001	10,545	11,546
TOTAL	2,655	1,707	16,869	21,231

26. The subscriptions to the *Bulletin of Entomological Research* and the fourteen abstract journals only, detailed in paragraph 28 increased in number during the year from 15,413 to 16,132. This is analysed in the following table:

Agency	1956	1957	Increase or decrease	Percentage increase
Institute of Entomology (3 journals)	3,431	3,430	— 1	—
Mycological Institute (1 journal)	1,441	1,449	8	0·6
Nutrition Abstracts and Reviews (1 journal)	1,597	1,699	102	6·4
Bureaux (10 abstract journals only)	8,944	9,554	610	6·8
TOTALS	15,413	16,132	719	4·7

There was an increase of 34 in subscriptions to the *Bulletin of Entomological Research* and the *Review of Applied Entomology, Series A*, but this was offset by a decrease of 35 in subscribers to the *Review of Applied Entomology, Series B*. This falling off was mainly due to the fact that in 1956 a large number of subscriptions to Series A and B were received from foreign institutes; in many cases it was subsequently found that only Series A was required and consequently the subscriptions to Series B for 1957 were not renewed.

27. Action taken to increase the sales of journals and occasional publications was as follows:

(i) Central Sales now distribute twice a year a *Publications List of the Commonwealth Agricultural Bureaux* to selected addresses. Some 5,000 of the April, 1957 list were despatched and 5,000 of the October, 1957 list. Leaflets describing new occasional publications and cyclostyled forms showing recent publications were inserted in the journals in considerable numbers. Interested people were given specimen copies of journals and, in some cases, many extra copies of certain numbers of journals were printed to be circulated to potential purchasers.

(ii) Publications were shown in book exhibitions organised by scientific organisations or associations of booksellers. During the year C.A.B. publications were displayed at book exhibitions in Baghdad, Gothenburg, Poznan, Leipzig, Cambridge, Amsterdam, Milan, Hamburg and Belgrade.

(iii) C.A.B. publications were also brought to the notice of scientists and the public generally by advertisements either paid for or exchanged with other scientific journals.

(iv) The annual report is sold and is also widely distributed free, thus permitting many persons to acquaint themselves with the work of C.A.B. if they so desire.

28. During 1957 the following volumes of the *Bulletin of Entomological Research* and the fourteen abstract journals were issued:

Bulletin of Entomological Research, Vol. 48
Review of Applied Entomology, Series A, Vol. 45
Review of Applied Entomology, Series B, Vol. 45
Review of Applied Mycology, Vol. 36
Nutrition Abstracts and Reviews, Vol. 27
Animal Breeding Abstracts, Vol. 25
Veterinary Bulletin, Vol. 27
Dairy Science Abstracts, Vol. 19
Forestry Abstracts, Vol. 18
Helminthological Abstracts (see next paragraph)
Horticultural Abstracts, Vol. 27
Herbage Abstracts, Vol. 27
Field Crop Abstracts, Vol. 10
Plant Breeding Abstracts, Vol. 27
Soils and Fertilizers, Vol. 20

With the exception of *Helminthological Abstracts*, the publication year of all the above journals is the calendar year and the first part or parts of the 1958 volumes were issued by the 31st March, 1958, the end of the year under review. With *Helminthological Abstracts*, the scheme is to bring the literature of each year into a single volume. The first parts of Volume 26 (1957) were issued during the year. The later parts containing titles and abstracts of papers published in relatively inaccessible journals will be issued as soon as possible.

29. Other periodical publications issued during the year were:

Distribution Maps of Insect Pests, Nos. 73-84	*Entomology*
Index of Fungi, Vol. 2, Parts 14 and 15	*Mycology*
Commonwealth Phytopathological News, Vol. 3, Parts 2-4, Vol. 4, Part 1	*Mycology*
Bibliography of Systematic Mycology, 1956	*Mycology*
Review of Medical and Veterinary Mycology, Vol. 2, Parts 9 and 10	*Mycology*
Distribution Maps of Plant Diseases, Nos. 339 to 352	*Mycology*
Index Veterinarius, Vol. 24 (1956) Parts 3 and 4, Vol. 25 (1957) Parts 1 and 2	*Animal Health*
Veterinary Reviews and Annotations, Vol. 3	*Animal Health*
Bibliography of Soil Science, Fertilizers and General Agronomy, 1953-56	*Soils*

30. The following occasional publications were issued during the year:

A Critical Review of the Techniques for Testing Insecticides by J. R. Busvine	*Entomology*
Mycological Papers, Nos. 67 to 70	*Mycology*
Phytopathological Papers, No. 2	*Mycology*
Parasite Catalogue, Section 2, Part 4	*Biological Control*
Salmonellosis in Animals. A Review by A. Buxton	*Animal Health*
Guide to the Use of Forestry Abstracts, Revised and Enlarged Edition	*Forestry*
The Mulching of Vegetables by Patricia Rowe-Dutton	*Horticulture and Plantation Crops*

SUMMARIES OF THE ANNUAL REPORTS FOR 1957-58, BY DIRECTORS

COMMONWEALTH INSTITUTE OF ENTOMOLOGY

31. It is very satisfactory to be able to report that, during the year under review, an opportunity arose of acquiring the freehold of No. 56, Queen's Gate. The necessary formalities are expected to be concluded very shortly.

Further difficulties were experienced on the bibliographical side owing to the resignation of certain members of the staff and the difficulty of recruiting suitable new staff. This has tended to retard the progress it was hoped to make in certain directions, more particularly in respect of the *Review of Applied Entomology*. Activity in the library showed a marked increase and the number of works sent out on loan was 20% higher than in the previous year.

32. Mr. G. S. Cotterell joined the staff in June, 1957 in a temporary appointment to assist the Scientific Secretary of the Inter-African Phyto-Sanitary Commission, the Secretariat of which is housed at 56 Queen's Gate. Mr. Cotterell's salary is met from the contribution received from the Commission for acting as its Centre of Information on entomological matters.

33. The number of specimens received for identification was lower, at 55,500, than the unusually high figure of the previous year (79,500), although the number of consignments involved, 603, was about the same (599). These were sent in by 277 (286) different correspondents, of whom 91 (91) were in Africa, 21 (22) in America, 51 (65) in Asia, 22 (24) in Australasia and Oceania and 92 (84) in Europe. The number of identifications sent out was correspondingly reduced to 7,089 (7,991) in 415 (492) lists, the distribution being Africa, 2,680 (3,931); America, 280 (248); Asia, 2,210 (1,681); Australasia and Oceania, 1,338 (1,602) and Europe 581 (529). Identifications were made for almost every unit in the Commonwealth, including some of the most remote. Apart from named specimens returned to senders, a combination of circumstances has led to a particularly large number of specimens being presented to the British Museum (Natural History), totalling 14,875 (11,840), including the types of 132 (69) species, and specimens of a further 463 (220) species not previously represented in the collections.

34. Twenty-five papers dealing with the results of taxonomic research have been published in various scientific journals by members of the staff (two having been written in collaboration with outside workers), and one monograph, totalling 839 printed pages.

35. Mr. E. A. J. Duffy returned in mid-June, 1957 from a visit to Trinidad and British Guiana in connection with the forthcoming volume, dealing with the Neotropical region, in his series of monographs on the immature stages of timber beetles, of which the volume on Africa appeared during the past year. This visit was financed jointly by the Governments of the two territories concerned, the Colonial Development and Welfare Fund and the Percy Sladen Trust, and his report on it has been circulated by the Colonial Office.

36. During the first half of the year, Mr. E. S. Brown, of the Colonial Pool of Entomologists, was working at the Institute on the reports and papers dealing with his study of the nutfall of coconuts in the Solomon Islands, caused by the Coreid, *Amblypelta cocophaga* China. In December, 1957 he left for the Middle East, on temporary secondment to the Foreign Office, for work, under the Economic Aid Agreement clause of the Baghdad Pact, on the Sunn Pest, *Eurygaster integriceps* Put. Mr. C. R. Wallace spent a short time at the Institute in July and August, 1957 in preparation for an assignment to study the insect pests on the Island of St. Helena; his work there has already indicated the need for control of the Eucalyptus Weevil (*Gonipterus scutellatus* Gylh.), and the Mymarid parasite, *Anaphoidea nitens* Gir., is accordingly being sent to him through the collaboration of the Division of Entomology of the Department of Agriculture, Union of South Africa. Dr. I. W. B. Nye has now virtually completed his survey of the pests of tropical cereal crops in East Africa and will require to spend some months at the Institute on his return, in the further study of material he has collected and in the preparation of reports and papers.

37. The total net cash receipts from all sales, including the sale of back volumes, amounted to £14,144 as compared with £15,582 in the previous year. This reduced figure is very largely due to the falling off in the demand for back numbers, a demand that is apt to show considerable fluctuations from year to year. The possibility of a sharp drop in demand, following the unexpected flush of orders in 1956/57, was forecast in the report for last year. It is noteworthy, however, that the number of subscriptions to the *Bulletin of Entomological Research* and the *Review of Applied Entomology* Series A both show rises.

38. The number of subscribers to the *Review of Applied Entomology* Series A, rose from 1,381 to 1,391 whilst that for Series B fell from 1,108 to 1,073. A large number of subscriptions to Series A and B were received from China for 1956; in many cases it was subsequently found that only Series A was required and the fall in subscriptions to Series B is largely due to the fact that several from China were not renewed for 1957. Subscribers to the *Bulletin of Entomological Research* rose from 942 to 966; of the 65 original articles published in this journal, about half were received from entomologists working overseas. The sales of back numbers of the two *Reviews* were half those of the previous year and those of the Bulletin were down by about 17%. Sales of reprints of articles published in the Bulletin amounted to about £679. It is disappointing that the number of subscribers to the *Distribution Maps of Insect Pests* showed a slight fall from 311 to 302. The demand for Occasional Publications remained steady and the net cash receipts for these and the Maps totalled £843 as against £643 in 1956/57.

39. The proportion of the receipts from sales of the Zoological Record, part Insecta, as agreed with the Zoological Society of London (3/5), amounted to £810 (£646). This increased figure is due to an

increase in the price of the volume and in the prices of back volumes. The annual contribution of £400 towards the cost of preparation of the Insecta was duly received from the Society.

Owing to the resignation of both the recorders early in 1956 to get married and the necessity of training replacements, one of whom has since left and been replaced, work on the Insecta has inevitably been somewhat slowed up. Vol. 92 (literature of 1955) was, however, issued in June, 1957 and Vol. 93 (literature of 1956) is in the press and it is hoped that it will be issued in May, 1958.

40. Accessions to the Library for the year amounted to 242 bound volumes and much the usual number of pamphlets, making a total of 14,013 volumes and 45,145 pamphlets. Parts of 693 serial publications were also received. The author catalogue is up-to-date for monographs but less complete for separates, although further progress has been made. The entomological contents of 71·3 per cent of the bound volumes of periodicals have been catalogued on cards by authors. The subject index to monographs is up-to-date and comprises 2,199 cards; the sheaf catalogue of serial and official publications is also up-to-date. The number of works sent out on loan at 1,804 showed an increase of 20% on the previous year. Microfilms and photocopies of 87 articles were obtained for entomologists in 9 Commonwealth and 4 foreign countries. The library was in daily use by the staff and visitors and, as usual, many subject and bibliographical enquiries from institutions and individuals, both in this country and overseas, were dealt with during the year.

41. During the past year requests to check extensive lists of insects have been received from India, Kenya and Trinidad. This has involved a very considerable amount of research on both the systematic and bibliographical sides. The names, both generic and specific, have been checked as well as the authors' names and many amplifying notes relating to references have been given.

Requests for information from all over the world covering a wide field have, as usual, been dealt with. These included enquiries for information on the construction of insectaria; the rearing of *Tipula* species in large numbers; the characters and distribution of *Scolia nigrita* and related species; history of the introduction of *Rhyssa persuasoria* into New Zealand and its establishment against *Sirex noctilio*; the control of mound-building termites in Nigeria; control of land crabs; literature on pasture insect surveys; on the control of ticks in relation to a disease spread by a virus transmitted from monkeys to men through ticks; on the development of resistance to DDT of *Heliothis* on linseed crops; references to recent publications on systematic insecticides.

42. The Institute continued to collaborate with the World Reporting Service of the Food and Agriculture Organisation, but the number of reports received from the Colonial Territories were so few that, instead of two half-yearly reports, it was only possible to send in one report for the year.

43. During the year the Colonial Termite Research Unit provided 122 identifications of termites, of which 52 were received through the Institute. These originated from many different localities, including England, Germany and Turkey; Saudi Arabia, India and Ceylon; Belgian Congo and Portuguese East Africa; British Guiana and the Virgin Islands. Articles dealing with the termites of Malaya, British Solomon Islands, East Africa and the Belgian Congo have also been published.

Advice on control measures, mainly in connection with buildings and building materials, has been given to official and commercial bodies covering an unusually wide range of country through Iraq and Persia to Singapore, Queensland and the Philippine Islands to the east, and in the west to British Guiana, Jamaica and Ecuador. There is a growing interest among manufacturers of fibreboards, plaster boards and similar products to make their products termite proof and so of increased value to users in the tropics. Living termites have been supplied to research workers in this country, and to university departments of zoology as a source of class material for protozoa.

44. It is a pleasure to record thanks to Sir Gavin de Beer, the Director of the Natural History Museum, and to Dr. W. E. China, the Keeper of Entomology, for the facilities accorded to the members of the staff of the institute who work in the museum and for the continued close and friendly co-operation of the staff of the Department of Entomology.

COMMONWEALTH MYCOLOGICAL INSTITUTE

45. A number of visitors made use of the herbarium and library including mycologists from Ghana, India (2), Iran (2), New Zealand, Nigeria, Pakistan and the Sudan, staying from a few days up to five months. Facilities were also provided for visiting students from British universities.

At the invitation of the Universities of Exeter and London, respectively, the Director delivered lectures to botanical students and participated in the post-graduate seminar on "Science in the New Commonwealth Countries" at the Institute of Commonwealth Studies.

46. *Library.* Progress has been made in the re-filing of the reprint collection and in re-arranging the publications in the store room. The latter have now been boxed and the floor of the room treated with a silicate preparation as a protection against dust.

47. Reprinting of out-of-print numbers of the *Review of Applied Mycology* has been pushed forward as fast as possible, 21 parts having been completed and a further 7 parts photographed, but the demand for back numbers is increasing faster than they can be reproduced.

Two supplements to the second edition of the catalogue of the Culture Collection, and the Bibilography of Systematic Mycology were again produced by the photo-offset method.

48. *The Review of Applied Mycology.* In view of the increase in volume and change in style of modern scientific literature and the increase in printing costs, it has been found necessary to review the abstracting policy of the *Review of Applied Mycology.* Whilst maintaining the recognised narrative style of the abstracts, a complete revision has been made of the orthographic conventions, which, together with a slight modification in layout, will enable a considerably increased number of abstracts to be included in vol. 37. The number of abstracts in volume 36 was 2,808 on 816 pages (2,083 in vol. 35 on 928 pages). It has also been decided in order not to reduce coverage that short directory notices will be printed where a full abstract is not warranted.

Through the kind offices of the new Russian section of the lending library of the D.S.I.R., cover of Russian and middle European journals has been greatly increased, 13 new publications having been added to the regular list: 17 volumes of regional floras of the U.S.S.R., from 1931-57, containing many descriptions of fungi, including new species, have also been discovered and abstracted.

49. The *Commonwealth Phytopathological News* appears to be gaining increased popularity and a number of enquiries have been made from outside sources as to the method of production of this publication. It is known that the *C.P. News* has a large number of readers but subscriptions are still disappointingly small and more personal subscribers are required before the *News* can become self-supporting at its present low subscription price of 5/- per annum.

50. *Pool of Plant Pathologists.* Mr. Holliday, in co-operation with Mr. Mowat of the Department of Agriculture, Sarawak, is continuing to establish supposedly resistant types of *Piper nigrum* collected last year in Indonesia and India. Mr. Holliday is also carrying out inoculation trials with the *Phytophthora* pathogen and further investigations are being made into the question of nematode attack on the roots. Difficulties are still being experienced by Miss Waterhouse in the cultivation of this *Phytophthora* in pure culture and it has not yet been possible to name the species.

Dr. Wheeler completed his preliminary survey of economic crop diseases in Malta and has prepared a report for publication. Over 120 bacterial, fungal, and virus diseases of economic importance have been recorded with the assistance of Drs. Dowson and Kenneth Smith of Cambridge. A report has been prepared for publication by the Government of Malta. Following a recommendation by Dr. Hopkins after his visit to Zanzibar, Dr. Wheeler has now proceeded to that island to investigate withertip of limes, which is reputedly holding up the development of the lime juice and oil industry.

It has been reported that no major outbreak of *Alternaria* leaf spot has occurred on the estates of the Colonial Development Corporation in Nyasaland since recommendations made as a result of the Pool investigation were put into practice.

51. *World Reporting Service on Plant Diseases.* The Institute continued to collaborate with the Food and Agriculture Organisation.

52. *Publications.* Total sales of publications and cultures amounted to £11,424, an increase of £1,418 on the previous year. Subscribers to the *Review of Applied Mycology* increased from 1,441 to 1,449 and total distribution from 1,747 to 1,756. Sales, however, realised £7,047 (back volumes £1,961) compared with £5,309 (back volumes £1,522) the previous year, an increase of £1,736 due to the bulk of 1957 subscriptions being paid in the 1957-8 financial year.

The final typescript of the index of volume 36 was sent to the press by 7th March, 1958, and by the end of the month the first proofs of the author index had been checked and returned.

Index of Fungi. Volume 2, parts 14 and 15, were published and the receipts amounted to £437 as against £409 last year; there was a gratifying increase of subscribers from 312 (1956) to 408.

Mycological Papers Nos. 67-70 by Dr. Ellis and Mr. Booth were published, sales amounting to £627 (£862, 1956).

Review of Medical and Veterinary Mycology. Volume 2 was concluded with part 10 in December,

1957, and a start was made in the preparation of a cumulative index. With the appearance of volume 3, part 1, in March, 1958, this journal was placed on a quarterly basis in order to guarantee its regular appearance. Sales increased from £367 to £634, but regular subscribers by only 10; probably as a result of intensive advertising a large number of complete sets was sold.

The annual *Bibliography of Systematic Mycology* (*Miscellaneous Publication* 14) edited by Miss Waterhouse was issued. *Miscellaneous Publication* 15, a report on Dr. Wheeler's investigations of *Alternaria* leaf spot on tobacco in Nyasaland, was prepared and sent to the press for photo-offset reproduction. *Miscellaneous Publication* 12 (The Genus *Phytophthora*) by Miss Waterhouse continues to be in constant demand. Sales of the *Miscellaneous Publications* series increased from £162 to £171.

Distribution Maps of Plant Diseases. There were 15 new and 9 revisions of maps issued, sales amounting to £231 (17 binders) compared with £305 (19 binders) in 1956-7.

Phytopathological Papers. Many orders for *Phytopathological Paper* No. 1 by Dr. Watts Padwick are still being received, sales for the year amounting to £125. *Paper No. 2* (Witches' Broom Disease of Cacao) by the late R. E. D. Baker and Paul Holliday was published and over 120 copies have been distributed. *Paper No. 3* (Club Root Disease of Crucifers caused by *Plasmodiophora brassicae*) by J. Colhoun is now in the page proof stage and should be ready for publication shortly.

53. *Information Services.* 73 orders for microfilms have been supplied to Canada, Czechoslovakia, Federation of Rhodesia and Nyasaland, France, Germany, Ghana, India, Iraq, Israel, Italy, Kenya, Malaya, Mauritius, New Zealand, Nigeria, North and South America, Poland, Sierra Leone, Uganda, United Kingdom, and West Indies, sales amounting to £55. There are now over 2,000 microfilmed papers in the library. 33 orders for photostats were completed.

128 books were acquired for the library and 170 sent on loan; 1,050 reprints were received and filed.

54. *Identification Service.* Specimens received numbered 3,495, bringing the total accessions in the herbarium to 72,433. The disposal and checking of all the rust collections have now been completed. 1,600 slides, mostly Meliolineae, were presented to the herbarium by Dr. C. G. Hansford. Specimens were also received from the Moscow Naturalists Society and collections by Dr. G. C. Ainsworth and Professor P. H. Gregory from Brazil.

Specimens for identification were received from the following Commonwealth countries, Aden, Australia (73), Canada, Cyprus (68), Ghana (258), Great Britain, Hong Kong, India (44), Kenya, Malaya, Malta (128), Mauritius, Nigeria (81), N. Rhodesia (189), New Zealand, Nyasaland, Pakistan, Papua and New Guinea, Sarawak (52), Seychelles, Singapore, S. Africa, S. Leone (40), S. Rhodesia, Tanganyika, Trinidad, Uganda; also from the Belgian Congo, French Cameroons, Guam, Holland, Iraq, Philippines, Sudan, Thailand, Turkey, U.S.A. and Venezuela.

55. New and interesting records were *Hyalodendron album* on bean from Malaya; *Sclerotinia ricini* on castor from S. Rhodesia; *Cercospora oryzae* on rice from Nigeria; *Leptosphaeria salvinii* on rice in Nigeria (new to Africa); more records of *Mycosphaerella musicola* in Sierra Leone; first record of a *Melampsora* (uredo only) on *Populus* from tropical Africa (Kenya); *Tolyposporium globuliferum* on *Leersia hexandra* also from Kenya.

Investigations. The most interesting pathological species received during the year was *Guignardia citricarpa*, isolated from grapefruit in Trinidad and from leaves of *Tabebuia* (Bignoniaceae) in Venezuela: in both places it had been found associated with a *Mycosphaerella*. The cultures were compared with isolations kindly forwarded from Australia, South Africa, and Japan. It is new to the herbarium.

Myrothecium adrena has been identified from South India, defoliating coffee seedlings. It is the fourth and last of the species of *Myrothecium* figured by P. S. Saccardo and is distinct from any form of *M. roridum*.

The two pycnidial fungi most frequently occurring on conifer resin in Great Britain have been finally identified as *Biatorella resinae*, as grown from ascospores at the Institute, and *B.difformis*, as grown from ascospores in Canada.

Colletotrichum capsici as repeatedly identified here on numerous tropical crops does not appear to be identical with the European *C. dematium*, and for the time being the latter name is not being adopted for the tropical pathogen.

The little-known species, *Nectria heterosperma*, was received on citrus stumps from Malta; it was grown from ascospores apparently for the first time.

Dr. Ellis continued his revisionary work on hyphomycetes, including the following genera: *Acarocybe*, *Melanographium*, *Coryneum*, *Curvularia*, *Cladosporium*, *Endophragmia*, *Helminthosporium*, *Pleurophragmium*, *Stigmina*, and *Thyrostroma*. This is an important part of herbarium work as nearly half of the specimens sent in for identification are hyphomycetes, a group including many important plant pathogens and spoilage organisms, especially in the tropics. Of the thirteen hundred genera of

hyphomycetes described probably less than 5 per cent. have been satisfactorily monographed.

Mr. Deighton continued to undertake routine identifications of Uredinales, *Cercospora*, and of West African fungi in general: he also undertook the checking of names of host plants of the many collections received from Ghana, and spent several months checking nomenclature and orthographical consistency of the list of seed-borne diseases prepared in collaboration with the International Seed Testing Association and on the recommendation of the 1954 Commonwealth Mycological Conference.

Several interesting new records of rust fungi were received from Ghana, Nigeria, and Northern Rhodesia, some of them apparently undescribed species. *Cercospora oryzae* Miy., a new record for West Africa, was represented by a collection on *Oryza sativa* from N. Nigeria, and one on the wild rice (*O.barthii*) from Northern Territories, Ghana.

A paper on some species of *Cercospora* from Africa with particular reference to Sierra Leone is in preparation.

Mr. Booth has revised species in the following genera: *Nectria*, *Otthia*, *Chaetosphaeria*, *Thaxteria*, *Gibberella*, and *Diplodia* and continued his identifications of Pyrenomycetes and Sphaeropsidales. He has commenced a study of *Fusaria* with nectroid perithecial states.

The following papers have been published by him or are in the press: "Two new species of *Microthyriella* in Britain" (*Kew. Bull.* 3, 1957); "The genus *Chaetosphaeria* and *Thaxteria* in Britain" (*Naturalist*, in press); "*Diplodia sarmentorum* conodia state of *Otthia spiraeae*" (*Trans. Brit. mycol. Soc.*).

Miss Waterhouse received 117 specimens and cultures for indentification or confirmation. They included many from Malta, part of Dr. Wheeler's collections; *Phytophthora* from pepper from Sarawak; a *Phytophthora* distinct from the normal black pod pathogen causing a stem disease of nursery cacao in Nigeria; Phycomycetes from cotton wilt in Aden, from fruit tree rots in the flooded areas of New South Wales, and from Cyprus and the Channel Islands. An interesting series of *Pythium* was received from root rots in Queensland and from palm rots in the Caroline Islands.

Miss Waterhouse published a paper on *Phytophthora citricola* in the *Trans. Brit. mycol. Soc.* and has another on *Pythiomorpha* and *Phytophthora* for the same journal in the Press. She assisted with the revision of the Society's "List of Common British Plant Diseases."

56. *Culture Collection.* New accessions numbered 228; 40 were discarded, bringing the total to 2,296. 1,335 cultures were issued: 697 to industry, 482 to research and educational establishments, and 156 free in exchange or issues to official workers on the free list. Sales amounted to £588, an increase of £45 over 1956-7.

No further trouble has been experienced with mite infestation. The maintenance of cultures under oil is proving eminently satisfactory and superior to freeze-drying which, although suitable for bacteria, is damaging to many groups of fungi. Very good results have been obtained by the use of glass cabinets, heated by low consumption heating cable, instead of incubators, as a number of very difficult fungi sporulate well in bright daylight, especially species with ascocarps, notably *Penicillium wortmanni* and *P.vermiculatum*, which normally lose the power of producing this spore form.

Dr. Brown completed a careful check of all the cultures of *Penicillium* spp. in the culture collection and has also provided fresh material for inclusion in the herbarium of specimens destroyed by beetles. It has been found necessary to store *Penicillia* in biscuit tins instead of folders as a protection against this pest.

Major Dade spent some time investigating moulding of lenses and prisms in optical instruments, some interesting conclusions being published in the *Commonwealth Phytopathological News.*

An increasing number of commercial firms are consulting the Culture Collection staff on industrial problems; some of the more important have been Jensen & Nicholson on the distribution of *Phoma pigmentivora* (paint mould); Moore's Modern Methods on the subject of deterioration of glue in the tropics; Robertson Bros. of Bromwick on the evaluation of fungicides; representatives of the Fairey Aviation Co. on mould-proofing; N. I. Hendey of the Admiralty Materials Laboratory on cultural techniques and the corrosion of metals in mould attacks; D. G. Coursey, of West African Institute for Oil Palm Research, on the deterioration of palm oil; and Mrs. Thompson, of the Shirley Institute, on technique.

Dr. A. H. S. Brown left the Institute on 14th March to be married and the vacancy has been advertised.

57. *Inter-African Phytosanitary Commission.* Mr. Altson has made good progress in the preparation of an index of plant diseases in Africa with a comprehensive bibliography; he has so far completed over 800 cards. He has also compiled a similar list of bacterial diseases not known to occur or of limited distribution in Africa, which has been sent to the Scientific Secretary of the IAPSC. The first two parts of this have already been distributed to participating governments. Mr. Altson is now engaged

on a list of virus diseases occurring outside Africa, for similar distribution.

Dr. Hopkins attended the second meeting of the Inter-African Phytosanitary Commission held in London in September, 1957.

58. *Overseas Visits.* Dr. Hopkins represented the Secretary of State for the Colonies on the East African Agriculture Research Council at two meetings in November, 1957 and February, 1958. On the first of these visits he spent three weeks touring agricultural research stations in the High Commission territories to discuss plant pathological problems with the local staffs. He also spent a week in Zanzibar to assess the importance of withertip disease of limes as a research project for the Pool of Plant Pathologists. On his second visit he paid particular attention to *Armillaria mellea* root rot of forest trees and tea, and also stem diseases of coffee.

Miss Waterhouse spent three months vacation leave on a tour of South Africa, during which she took the opportunity to visit a number of mycological and plant pathological laboratories.

COMMONWEALTH INSTITUTE OF BIOLOGICAL CONTROL

59. The work of the Commonwealth Institute of Biological Control has been directed throughout the year from the Ottawa headquarters. Substations have been maintained in California, U.S.A.; Trinidad, B.W.I.; Bangalore, India; Rawalpindi, Pakistan; and Zurich, Switzerland. However, the Zurich station on the advice of Dr. Mesnil and after a personal study of the matter by Sir Herbert Howard, was moved from Feldmeilen to the town of Delemont (Canton of Basle) about twenty miles from the city of Basle). This move was made necessary by the steady increase of building around the Feldmeilen laboratory and the progressive restriction of facilities for outdoor and field work. In the new location, there is much better accommodation for the scientific staff, easy access to varied agricultural and forest areas and space for insectaries in the laboratory grounds. Delemont is on a main railway line, with easy access to Basle with its airport. Basle itself has a University with Departments of Botany, Entomology and Zoology. It has also valuable entomological collections. The small substation at Mendrisio in Southern Switzerland has been closed as it has been found more advantageous to have the small staff located in one centre. The laboratories in India and Pakistan were completed and equipped to the extent made possible by grants from the Canadian Government under the Colombo Plan, supplemented in the case of the Rawalpindi laboratory by grants from the Government of Pakistan. After working for many months with Dr. Rao and Dr. Ghani, the officers-in-charge appointed to the staff of the Institute, Mr. W. F. Sellers left India for London on 6th October and, after a short stay there, reported at headquarters in Ottawa early in December. He left for Fontana, California at the end of January.

60. Work on special projects was carried out for Australia, Barbados, Bermuda, Canada, Fiji, Hawaii, India, Italy, Jamaica, Mauritius, New Zealand, Nevis, Pakistan, Sao Tome and Principe and Trinidad. Four hundred and thirty shipments of material carrying beneficial insects were made, involving almost eight hundred and twenty thousand specimens. Project accounts paid or due for the financial year totalled approximately $33,000. Thus, though the project funds received were somewhat less than in 1956/57 one hundred and seventy more shipments were made and the number of insects shipped was over five times as great. This was due partly to a change in the Canadian project programme, which in 1957/58 included several assignments in which it was easy to organize large collections; but an important factor was the activity of the Indian station which made one hundred and sixteen shipments involving over ninety thousand insects. This station has access to rich sources of material of interest to a number of tropical and sub-tropical areas of the Commonwealth. However, both the Rawalpindi and the Bangalore stations have been asked to take up work on the natural enemies of the Fir Chermes (Adelges). During the last few years the infestations of Adelges in Western Europe have declined almost to the vanishing point. The pest has appeared in the coastal areas of the Western United States, so co-operative arrangements for collection by the institute and the entomological section of the United States Forestry Service have been made and this work will be continued in Europe, the Indian sub-continent and Japan. Material collected by the Rawalpindi laboratory has already been sent for identification to our entomologists at Delemont.

61. In addition to the field surveys connected directly with projects, research leading to the preparation of scientific papers has been continued along much the same lines as last year. Mr. Sellers has completed a paper on the methods of mass-breeding scale insects and scale-feeding Coccinellids. Dr. Mesnil has continued his systematic work on the Tachinids of the world. Dr. Lloyd has continued experimental work on host selection in certain Chalcid parasites of mealy bugs. Dr. Simmonds has

continued his studies of the Oleander Scale and the Green Scale in Bermuda and has successfully introduced the West Indian Kiskadee which it is hoped will reduce the lizard population. As noted in the last report, the investigations of Dr. Simmonds have suggested that lizards, together with certain ants, have been the main obstacles to the establishment and increase of lady-bird beetles in Bermuda. It is not yet known whether the Kiskadee (which is a species of shrike) will survive in Bermuda and it has not yet been observed to feed on the Bermuda lizards. Dr. Delucchi, Dr. Pschorn and Dr. Zwölfer have continued investigations on the natural control of oak-leaf miner, oak and fir tortricids, and the Silver Fir Chermes as well as on the systematics of Chalcids, Proctotrupids and subterranean Aphids. Mr. Bennett has continued his studies on West Indian Encyrtids and has also studied, in collaboration with Mr. S. N. Brown, the problem of sex determination in the Oleander Scale. Finally, the Director has carried some preliminary investigations on the larval forms of the Tachinids of the genera *Siphona* and *Trichoparia* which are parasitic on Tipulids; since work on the parasites of Tipulids has been assigned as a Canadian project during the coming financial year. Twenty-one papers have been published by members of the staff during the financial year.

62. Part 4 of Section 2 of the Host *Parasite Catalogue*, covering the hosts of the Ichneumonidae (288 pages) was published during the financial year. One hundred and seventy-eight volumes of the Catalogue were sold.

COMMONWEALTH BUREAUX

Animal Breeding and Genetics

63. *Staff.* There were no changes.

64. *Accommodation and Equipment.* There was nothing to report.

65. *Publications.* Volume 25 of *Animal Breeding Abstracts* contained five review articles, 2,053 abstracts and 132 titles derived from papers in 20 languages. The Subject Index was issued promptly soon after the fourth part was published. Total coverage was 490 journals. Abstracts from Russian papers again increased and now represent 11·7% of the total. East European languages accounted for 8·4%, a slight increase on Volume 24.

66. A Supplement to Technical Communication No. 8, "A World Dictionary of Breeds, Types and Varieties of Livestock", was published in July, 1957. Three new Technical Communications were in the press at the end of the year.

67. *Information Services.* There were 56 requests for information during the year, 27 of which came from within the United Kingdom, 18 from Commonwealth countries and 11 from foreign countries; a note on the more interesting enquiries is given below. Five translations were undertaken and 2 requests for photostat copies of papers supplied.

68. *Library.* The Bureau issued on loan a total of 736 books and journal parts and borrowed 1,122 publications. We now have 1,800 books in the bureau library.

69. Requests for information covered the usual wide range of topics and a few examples are given:

(i) a request from Kenya for information on the origin of Jerseys, and for data on their skin thickness in comparison with other breeds;

(ii) from Northern Rhodesia a request for sources of data on the growth rate of Boran cattle (some of which have been imported to Northern Rhodesia from Kenya). It was only possible to indicate probable sources, as there are hardly any data on this;

(iii) a New Zealander working at Edinburgh was supplied with references to papers in English on animal production in Southern Europe preparatory to a visit to research stations in Italy and France;

(iv) a request was made by the Israeli Agricultural Attaché in London for proposals regarding suitable mutton and wool breeds of sheep for Israel, and the problem was discussed with him and the Director of Land Settlement at a meeting in Edinburgh;

(v) information on methods of estimating lactation yield was sent to the Indian Council of Agricultural Research;

(vi) information on the extent of the polled condition in Zebu cattle (published data on which are scarce) was supplied to the bureau's Official Correspondent in Uganda.

Animal Health

70. All three of the regular publications were up-to-date. The volume index for *Veterinary Bulletin* Vol. 27, is in the hands of the printer and should be issued by the end of April, 1958.

71. *Veterinary Reviews and Annotations* now in its third year has not shown as great an increase in sales as had been hoped for. Subscriptions increased from 358 to 428 and the total issue, including quota, free and exchange copies, of Part 2 of Vol. 3 was 588.

72. No Technical Communications were published during the year. One dealing with fungal diseases in animals was in an advanced stage of preparation at the end of the year. It is to be printed by the Photo-offset process.

73. The information service dealt with 94 enquiries (74 from the United Kingdom, 6 from the Dominions, 3 from Overseas Territories, 2 from the Republic of Ireland and 9 from foreign countries). Among the subjects on which information was sought were the following: Diseases of fur-bearing animals; agalactia in sows; systematic parasiticides; incidence of salmonella organisms in feeding stuffs, such as meat and bone meal; life span of erythrocytes in animals; anthrax and tortoises; absorption and excretion of carbon tetrachloride by ruminants; radio-activity of animal bones; Teschen disease of pigs; air pollution; action of cortisone on chickens and many others. The library dealt with 735 requests for loans; 38 photostat copies of articles and 16 translations were supplied.

Animal Nutrition

74. The Director and the Assistant Director attended the Fourth International Congress of Nutrition held in Paris in July under the auspices of the International Union of Nutritional Sciences. In association with Dr. F. E. Hytten the Director presented a communication entitled "Weight of mammalian mothers and young at birth".

75. *Publications.* Considerable additions made at the end of 1956 to the number of journals scrutinised led to an increase in size and content of *Nutrition Abstracts and Reviews* by more than 10 per cent. The system of recording notices of papers read at symposia and conferences in a separate section of the journal has been found satisfactory and is being continued.

A second review article on the subject of secular change in the physical development of the population in Britain was prepared in association with Mr. A. W. Boyne; it dealt with measurements of height and weight of children and included an analysis of measurements of English children in primary schools.

76. *Information Service.* Of the requests for information, 28 in number, which were received from Commonwealth countries, 21 originated in the United Kingdom. There were 6 from countries outside the Commonwealth. Requests for loans of publications numbered 40 and 4 translations were prepared. Two typescripts, 2 photostat copies and 4 microfilms were supplied.

Most of the enquiries were concerned with feedingstuffs for livestock in general. They referred to such subjects as predigestion of straw and rice hulls, use of inedible fats, crabmeal, phosphates, antibiotics and hormones. Some were on the composition of plant materials, *Centrosema*, cocoa pods and moor plants.

Two enquiries were on the feeding of small mammals, cats and mink, and two were on human nutrition, one from Australia on the need for milk in schools and the other from South Africa on fish flour for human consumption. An interesting search was for a description of a cannula used by Zuntz in 1889 in studies of energy exchange in the horse.

Dairy Science and Technology

77. *Staff.* The year was marked by a number of staff changes. Mr. A. W. Marsden resigned his Directorship in July, and Mr. E. J. Mann was appointed Director in October. A badly needed fifth Scientific Assistant was appointed during the year.

78. *Publications. Dairy Science Abstracts* appeared regularly and punctually every month. Volume *19* (1957) contained 2,636 abstracts and 520 title entries. Each monthly part contained a review article, the articles being written by authors from 6 different countries.

Coverage of the literature is continuing to increase and 506 journals are now scanned regularly, apart from numerous bulletins, annual reports, books and other publications. About 40% of all abstracts and titles which appeared in Volume 19 of *Dairy Science Abstracts*, were from foreign languages. German was the most important foreign language but there has been a significant increase in the literature from the U.S.S.R. and its neighbours.

79. *Advertisements.* The journal is continuing to be a useful medium for commercial advertising and Vol. *19* contained 39½ pages of paid advertisements.

80. *Distribution of Dairy Science Abstracts.* The number of subscribers rose markedly from 886 for Volume 18 to 993 for Volume 19 and total distribution of the journal from 1,084 to 1,182 respectively.

81. *Information Services.* A total of 169 enquiries were received and dealt with during the year. Of these, 92 came from Great Britain, 32 from different parts of the Commonwealth and 45 from foreign countries.

The nature of the enquiries varied considerably, from straightforward requests for photostat copies of specific papers to the preparation of elaborate bibliographies. Most of the enquiries were of a topical nature and reflected recent trends and developments in different fields of dairy science and

technology. Typical examples were as follows: methods of measuring liquid levels in milk tankers (Australia); bulk milk collection progress in the U.S.A. (U.K.); effect of use of hormone sprays on grassland on cheese quality (U.K.); information on milk payment scheme according to protein content in the Netherlands (New Zealand); treatment of milk by ionizing radiations (Germany); effect of Windscale flare-up on milk (Australia); ways of skim-milk utilization (Pakistan); information on methods of milk analysis (Malta).

Forestry

82. *Staff.* An eighth Scientific Assistant was appointed in February and has started intensive training.

83. *Publications.* (*a*) The preparation of *Forestry Abstracts* continues to be the major occupation of the scientific staff. All numbers appeared punctually in the first month of the respective quarters; the usual four-part index has gone to press. Volume 19(1) opened with a new type of leading article intended to give the forestry specialist some knowledge of research developments in fields outside his own. Volume 18 contained 4,848 abstract notices which were derived from publications in 29 languages.

(*b*) *Coverage of literature.* This has reached an all-time high, comprising 1,401 periodicals and serial sets.

(*c*) The enlarged edition of the *Guide to the Use of Forestry Abstracts* (now in four languages) was published in March, 1958. *A Progress Report, The Work of the Commonwealth Forestry Bureau,* 1952-57, was printed and submitted to the Seventh British Commonwealth Forestry Conference.

84. *Information Services.* (*a*) A total of 28 enquiries was received from member countries and 4 from outside the Commonwealth. Among topics on which information was provided were:

(i) Physiological changes from sapwood to heartwood;
(ii) silviculture of *Khaya nyasica*;
(iii) the Dunemann system of nursery practice;
(iv) growing Christmas trees in Great Britain;
(v) electronic detection of *Hylotrupes bajulus*;
(vi) inventory of second-growth hardwoods using air photos;
(vii) timber royalties in the Commonwealth;
(viii) timber properties of fire-killed trees;
(ix) profitable uses for *Avicennia* and *Rhizophora* mangrove forests;
(x) eucalyptus oils and their distillation (in co-operation with the Bureau of Horticulture and the Colonial Products Laboratory, now the Tropical Products Institute).

A complete bibliography on *Pinus pinaster* was supplied to W. Australia.

(*b*) In addition there were 67 requests for literature and 2 for microfilms. Two minor translations were supplied.

85. *Miscellaneous.* The Centralized Title Service continues to expand, but, as anticipated, more in terms of sets taken than subscribers. It now goes to 34 Commonwealth and 53 foreign centres all over the world, at an approximate rate of three-quarters of a million master cards per year.

86. Accord has at last been reached between the Bureau and the International Federation for Documentation for the incorporation of the Oxford Decimal System of Classification for Forestry into the UDC with effect from July, 1957.

87. This Bureau continued to run the Botanical Pool of circulating literature (some 230 items) and to distribute scientific literature received at Head Office.

Helminthology

88. *Identifications.* Materials received for identification were dealt with by the Director pending the appointment of a taxonomist.

89. *Publications.* (*a*) Volume 23 of Helminthological Abstracts, with author, subject and periodicals indexes, was completed and published during the year.

(*b*) The second edition (1956) of the nematode parasites of *plants* catalogued under their hosts is being reprinted and a supplement of additional records is being prepared by Dr. J. Basil Goodey and Dr. Mary T. Franklin.

90. *Information Service.* Thirty requests for information, from member countries, were dealt with. The topics included:

Susceptibility of varieties of clovers to eelworm infection; names of suppliers of seed of clover varieties resistant to eelworm; control of lucerne stem eelworm; regional phytosanitary regulations against plant-parasitic nematodes; techniques for studying eelworms.

Ants as vectors of the lesser liver-fluke of sheep; mermithid parasites of wasps; beetles as vectors of *Spirocerca lupi* in dogs.

Endemic areas of filariasis and onchocerciasis suitable for filming.

Last recorded instance of *Cysticercus cellulosae* in pigs in Britain; statistics on the incidence of hydatid cysts in man in recent years in the United Kingdom.

The use of delta isomer of benzene hexachloride for the control of molluscan vectors; suspectibility of laboratory animals to experimental infection with lungworm parasites of sheep; effect of chlorination on Ascaris eggs in sewage.

On the lay-out of a host-parasite catalogue; location of type collections of helminths in the United Kingdom; advice on suitable institutions for postgraduate study of helminthology in the United Kingdom.

91. Requests for the loan of specific items of literature numbered 126.

92. Three translations were supplied on request: one from German and two from Russian.

93. *Miscellaneous.* Overseas visitors to the Bureau included Professor W. P. Rogers (Australia), Dr. Devendra Prasad (India) and Professor J. M. Watson (Iraq).

Horticulture and Plantation Crops

94. *Publications. Horticultural Abstracts.* The whole of Vol. 27 including index was already published by mid-January, 1958. It contained abstracts, notes or reviews of 5,579 original publications including 75 books. The number of subscribers rose from 1,166 to 1,218.

Progress was indicated and emphasized by the feature known as Salient Items in each number.

Technical Communications. T.C. 24. The Mulching of Vegetables by a member of staff, Patricia Rowe-Dutton, was issued and received highly favourable press comment.

95. *Enquiries* (Commonwealth 112, Foreign 33). An average number of enquiries was dealt with. Clients being notified in 1957/58 of the availability of replies to 50 new enquiries, 146 persons requested and received copies, the actual number of items actually despatched in this way being 698.

Two enquiries of particular interest to tropical workers concerned weed control in coffee and the control of the aquatic weed, water hyacinth. The sub-tropical horticulturist comes into the picture with his problem of the control of delayed foliation in deciduous fruit trees. Mist propagation technique again formed the subject of several enquiries. Finally in 1957 two very different subjects called for notes on progress viz: the potential uses of gibberellin and the very down-to-earth subject of labour efficiency in horticulture, which attracted attention and enquiries from several quarters.

96. *Translations.* Among short translations requested and made were one each from Dutch, German, Italian, Spanish and Swedish, 2 from Portuguese and 4 from Russian.

97. *Publicity.* This consisted mainly in circularizing some 230 selected addresses with accounts of bureau activity and providing them with sample copies of Horticultural Abstracts.

Pastures and Field Crops

98. *Publications. Herbage Abstracts* and *Field Crop Abstracts* appeared regularly each quarter. A review article was included in each issue of both journals, as well as the usual abstracts and titles which totalled 1,602 in *Herbage Abstracts* and 1,690 in *Field Crop Abstracts.* Abstracts were derived from publications in 12 languages. The annual subject and author indexes of both journals were published with the last issue of each volume. A revised list of periodicals and reports examined by the Bureau was issued in January, 1958 and distributed with *Herbage Abstracts* and *Field Crop Abstracts.* Ninety-two publications were added to the coverage, making the total 1,006. Because of the continuing demands for them, Bulletins 42, 43 and 44 were reprinted.

99. *Information Services.* Seventy-four enquiries (contributing countries 70, foreign 4) were dealt with and 214 requests for references to scientific literature. The enquiries covered the following subjects, amongst others:

Sowing depth of herbage seeds; pelleted seed in Australia; cost of seed production in Denmark; harvesting of herbage seed crops; changes in composition of grasses and clovers with increasing age; gang-mowing of pastures; grazing behaviour of the dairy cow; potato silage; grasses and herbage species for tropical countries; Bermuda grass U.3 hybrid; chicory and sainfoin; control of wild onion (*Allium* spp.); potato varieties for the chip trade; rice in the Camargue; nitrogen changes in the wheat plant during growth.

100. *Distribution of abstract journals.* 300 free specimen copies of abstract journals were sent to selected individuals and institutions, mainly overseas, inviting them to subscribe. There was a small increase in the number of subscribers; 4½% for *Herbage Abstracts* and 8½% for *Field Crop Abstracts.*

101. *Staff.* During part of the year this was below strength.

Plant Breeding and Genetics

102. *Plant Breeding Abstracts* continued to appear punctually at the beginning of each quarter. The index to the last completed volume is in the press. Volume 27 contained 4,624 abstracts, 105 book reviews and 10 new-journal notices. Publications in 35 languages were examined for the preparation of *Plant Breeding Abstracts,* and four other languages were dealt with in the course of the bureau's work.

103. There were 38 technical enquiries from contributing countries. These included requests for information on the following topics: pollen storage of cereals, field-trial methodology for cereals, Chinese work on dormancy in wheat, factors influencing flowering in vegetable crops, insect pollination of *Brassica* crops, the genetics of resistance to *Corynespora melonis* in the cucumber, and the evolutionary history of *Phaseolus*, for Great Britain; the breeding systems of *Acacia* and *Leucaena*, for Australia; genetics, cytology and breeding of small-grain cereals, wide hybridization in wheat, and wheat taxonomy, for Canada; pomegranate cytology, and induced polyploidy in grapes, for India; the Larroque selection method, for Kenya; the effect of temperature on male fertility in the sugar cane, for Mauritius; interspecific hybridization in groundnuts and rice, for Nigeria; maize-teosinte hybrids, and the breeding of medicinal plants, for Pakistan; Hibiscus fibre plants, for Southern Rhodesia; rust resistance in lucerne, for Swaziland; soya beans in the tropics, for Tanganyika; and arrowroot breeding for Trinidad.

Enquiries were also dealt with on behalf of F.A.O. and Compania Shell in Venezuela.

104. Requests for specific items of literature totalled 108; 52 requests were made for bibliographies previously compiled. Five translations were made, two from Japanese and one each from Hungarian, Russian and Swedish.

105. Assistance in obtaining genetic material has been rendered as follows: oats and *Beta* spp. for Great Britain; birdsfoot trefoil, for Canada; and tomatoes, for the Republic of Ireland.

106. The visitors to the bureau included S. Barbacki, from Poznan, J. Unrau from Canada, and M. G. Weiss, from Beltsville, U.S.A.

107. Sir Joseph B. Hutchinson was appointed consultant director to the bureau on the retirement of Sir Frank L. Engledow.

108. The director continued his work on the International Commission for Cultivated Plants and visited research stations in Germany working on the induction of useful mutants of crop plants at the request of the Agricultural Research Council.

Soils

109. Abstracting and publication of *Soils and Fertilizers* are up to date. Volume XX (1957) contained 2,348 abstracts and six review articles. About twice as many papers were abstracted and indexed, but not noted in *Soils and Fertilizers*. The number of periodicals scanned has not altered appreciably.

110. No Technical Communication was issued during the year. Two are in course of preparation: *Water Relationships of the Soil* and *Vegetation, Climate and Water Supply*. The eighth volume of the *Bibliography of Soil Science* (1953-1956) was published.

111. The number of enquiries received was 109, compared with 119 last year. Of these 51 came from the United Kingdom and 26 from other Commonwealth countries. Among the subjects on which information was supplied were: decomposition of forest-litter (U.K.); use of radio-phosphorus in fruit tree studies (Trinidad); effect of ammonium on phosphorus nutrition (Mauritius); toxicity of root excretions (Kenya); earthworm casts (New Zealand); organic matter and shifting cultivation (Ghana).

112. 12 translations were made from Russian, 3 from German, 2 from Dutch, 2 from Czechoslovakian and 1 each from French, Swedish, Danish and Spanish.

113. 76 annotated bibliographies were prepared.

NOTES OF PROGRESS IN THE AGRICULTURAL SCIENCES, BY DIRECTORS

Biological Control*

114. Work in the field of biological control has passed through a series of phases. In the earliest days, following the observations made on the beneficial enemies of animal and plant pests, recommendations for their 'encouragement' were made by naturalists. Occasionally attempts were made to do this. The experiments were carried out with indigenous insects; they were poorly planned and inadequately executed. There is no evidence that they were successful.

115. The next phase arose when the movement of populations and food materials between various parts of the world produced, as an incidental and unforeseen result, the transfer of animal and plant pests without the natural enemies which attacked them in the countries of origin. The outbreaks that sometimes followed the transfers led to a search for the natural enemies in the country of origin and their introduction into the new home. Almost seventy years ago an outstanding success was obtained by the introduction from Australia into California of a lady-bird enemy of the Australian Fluted Scale, which threatened the Californian Citrus industry with destruction. From that date the method followed has remained the most important aspect of

*The references, unless otherwise designated, are to the volume and page of the *Review of Applied Entomology*, Series A.

biological control work, its necessity being maintained by the great increase in exchange of animal and plant materials and the tremendous increase in the speed of this exchange so that pests which could not survive a long sea voyage arrive in excellent condition in a place where they can easily become established and succeed in doing so in spite of the development of quarantine services. To cope with the problems that arise, biological control specialists and services have developed in many parts of the world.

116. The development of biological control services naturally led to more accurate scientific studies of the natural enemies of pests and eventually to reflection and speculation on the fundamental problem of 'natural control' of which biological control is simply one special aspect. Since the problem is essentially a problem of numbers, the theories developed in connection with it have tended to assume a mathematical form. The field studies of pest populations show that they vary numerically or may be described as oscillating and from this some naturalists have concluded that they are cyclical or rhythmical and therefore determined by factors causing a regular and cyclical effect. If we assume that the numbers of organisms are controlled by density-dependent factors and express this assumption in mathematical terms, we can deduce a cyclical process which might be produced by the interaction of parasite and host populations. A theory of this type, formulated long ago by several naturalists and mathematicians, tends in a general way to support the views of those who regard the parasites and predators of injurious insects as the main factor regulating their numbers and has therefore been found attractive by a number of specialists in biological control and, because of its clear-cut simplicity, by many ecologists.

117. Now, however, it is becoming recognized that the variations in populations are much less regular, while the causes involved are much less constant and much more difficult to specify than the prevailing theory has assumed. L. C. Cole, in an important paper presented at the Tenth International Congress of Entomology, showed that the apparent regularity of population change, used by ecologists as a proof of the existence of density-dependent controlling factors, may be the result of chance and that cycles as impressive as any found in nature may occur in a series of random members. F. Schwerdtfeger reached the same conclusion as a result of practical experiments and showed that the random series obtained coincided with his observations on the populations of certain forest insects. A. Milne (*Canadian Entomologist*, 89, 193-213), by a critical analysis of the field work of G. C. Varley, regarded for many years as a conclusive demonstration of the vital importance of density-dependent factors, showed that the data do not support the conclusions drawn from it. He is thus led to the conclusion, advanced in 1929 by W. R. Thompson (*Parasitology*, 21, 269) and later supported by H. G. Andrewartha and L. C. Birch (see Milne, l.c.) that the natural control of organisms is fundamentally due to the specific intrinsic limitations of the organisms themselves and to the fact that the natural environment, varying from point to point and from moment to moment, frequently departs more or less from the ecological optimum and often owing to the action of the organism itself as when a plant-feeding insect annihilates the available food before it can reach maturity.

118. The theory of 'natural control' has thus developed in a direction that requires inductive rather than deductive treatment. In Canada the long-range investigations of the forest entomologists, under the direction of M. Prebble, of the field populations of Larch Sawfly, Tent Caterpillar and Spruce Budworm, are planned with the object of discovering the real causes of mortality in successive stages of development, over a series of generations. The varied causes and the unpredictable character of population changes is clearly brought out. Blais, Prentice, Sippell and Wallace (*R.A.E.*, 45, 6) found that an epidemic of *Malacosoma disstria* was drastically reduced by cold weather in 1953, after high temperatures in early May caused the leaves to unfold and the eggs to hatch. In northern Ontario, freezing temperatures followed for several days, and this killed many young larvae and more died of starvation, owing to the killing of the foliage; further west, where frosts were not so severe, the cold wet weather after hatching killed off 90% to 95% of the larvae.

119. In the detailed and long-range investigations mentioned, there have, it is true, been important mathematical developments but these are for the most part along statistical lines designed for the evaluation of the data collected and for the planning of the work in such a way as to give significant and intelligible results.

120. Detailed studies of the habits and interrelations of natural enemies and their hosts have produced interesting and suggestive results. Henderson (*R.A.E.*, 44, 416) found in Idaho that the egg parasites of the beet leaf hopper do best where Russian thistle, which is the principal summer food plant of the Leaf Hopper, is common in the neighbourhood of beet fields. Henderson (*R.A.E.*, 44, 415) observed also that the adult leaf-hoppers, when they carry Dryinid or Pipunculid parasites, have restricted power of flight and are therefore left behind

by the healthy adults in their long migrations so that the leaf-hopper can increase unchecked. Verma (*R.A.E.*, 44, 434) working in Hawaii, found that the Mirid bug, Cyrtorhinus mundulus, which has been very effective against the sugar-cane leaf hopper *Perkinsiella saccharicida*, does not control the leaf-hopper *Peregrinus maidis* on maize. This is because the stages of maize growth suitable for oviposition and egg development of the two species do not coincide, the eggs of Peregrinus are laid on roots which are not accessible to the predators, ants that favour Cyrtorhinus attack Peregrinus and maize develops over too short a period and affords insufficient protection to the predators against wind. Debach (*R.A.E.*, 45, 378) in California made a close study of the relative efficiency of two red scale parasites of the same genus. He found that *Aphytis lingnanensis*, liberated in areas where *A.chrysomphali* is already well established, generally becomes the dominant species within a few years. This, he believes is due to the longer life and higher fecundity of *lignanensis*, its greater destruction of the host by adult feeding and the greater resistance of the eggs to high temperature.

121. The trend toward more exact investigations of the reasons for the success or failure of the natural enemies of pests as controlling agents, seems likely to lead and has led in some cases to a revival of interest in the possibility of increasing the efficiency of parasites and predators by various procedures. The investigations on the effects of chemical control on parasites and predators and the efforts to produce insecticides effective against pests but harmless to their natural enemies or to time applications so as to get an advantageous differential effect, have been noted in previous reports. These studies are still going on. However, in some parts of the world, the redistribution or mass liberation of indigenous parasites which had fallen into disfavour are again being attempted. The entomologist of Barbados has always claimed that the mass liberations of the egg parasite Trichogramma is, in that island, a satisfactory method of controlling the sugar-cane borer; but reports elsewhere have been unfavourable. Recent work with indigenous parasites has been noted mainly in India and Russia, probably because conditions in those countries are not particularly suitable for the general use of insecticides. Telenga, (*R.A.E.*, 45, 474) working in European Russia, claims that the liberation of Trichogramma at the rate of four thousand to eight thousand individuals an acre reduces the numbers of the cutworm *Agrotis segetum* by 70% to 80%. He claims also that the release of this parasite, supplemented by other control measures will in certain areas protect about 95% of apple fruits from infestation by the codling moth. Bogdanova (*R.A.E.*, 45, 47) states that the Coccinellid, *Hyperaspis campestris* can be used for the control of *Pulvinaria floccifera* on tea plantations. The beetles are collected in the field at the end of summer, and liberated early in the following year. It is said that the liberation of 400 per acre will bring the scale below the level of economic importance in two or three years. In Germany, Drees and Schwitulla (*R.A.E.*, 46, 2) found that the redistribution of the cocoons of *Apanteles solitarius* brought *Lymantria dispar* under satisfactory control though chemical methods were required in neighbouring areas. In India Tirumala Rao, David and Mohan Rao (*R.A.E.*, 44, 215) attempted to check the infestation of citrus and coconut by certain scale insects, by liberating colonies of *Chilocorus nigritus* bred in the laboratory. They found that it is not effective alone but did prevent infestation from wild plants. Pingale (*R.A.E.*, 44, 219) claimed that the liberation of the Reduviid *Amphibolus venator* in a warehouse containing grain infested by *Ephestia* and *Alphibabius* produced a definite reduction in damage. Issakides (*R.A.E.*, 45, 84) reviving a method suggested long ago by F. Silvestri, claims that by encouraging in olive groves plants carrying the alternate hosts of olive fly parasites, good control of the pest can be obtained. Janvier (*R.A.E.*, 45, 87) states that in certain regions of France where hedgerows exist around small fields and are trimmed by hand, these conditions favour nest building by predacious Hymenoptera and these help to control insect damage. He claims that when the hedges are replaced by wire fences, insect damage to the crops steadily increases, necessitating the use of more insecticide each year.

122. By the use of modern techniques and apparatus particularly the electron microscope, great progress has been made in the study of insect diseases particularly the viruses. Promising results have been obtained by the artificial diffusion of some bacteria and viruses. To give only one example out of many that might be cited, Ossowski (*R.A.E.*, 45, 385) in South Africa found that the artificial dissemination of a virus disease of the wattle bagworm is likely to keep this pest in check for several years.

123. It therefore appears, that in spite of the tremendous advances in the field of insectidal control, the possibilities of the biological method are by no means exhausted and that it is destined, particularly in the areas where technical experience and equipment are lacking and labour is inexpensive, to play an increasingly important part in relation to insect and plant pests.

Dairy Science

124. *Milking method.* As efficient manpower has become increasingly scarce and expensive, most

attempts at reducing milk production costs have been aimed at reducing labour requirements. Many results of farm surveys and work-studies have been published, contrasting output per man and per hour for various types of layouts, machines and milking routines (*D.S.A.* Vol. *17*, 573 *a*, 648 *a*, 1009 *a*, *18*, 28 *b*, 561 *a*). The herringbone shed is arousing considerable interest, not only in New Zealand where it was originally devised, but also in Great Britain and other countries (*D.S.A. 18*, 218 *a*, *20*, 211 *d*).

In Holland and Germany the use of co-operative or contractor owned and operated mobile milking lorries has been an interesting move towards the more rational and efficient use of labour. Each lorry is equipped with milking machines and recording, sampling, cooling, cleaning and storage facilities. One lorry unit, operated by 2 men, can milk a total of 80-120 cows comprising small herds of 8-20 cows each (*D.S.A. 18*, 1015 *c*, *19*, 194 *20*, 296 *c*).

In Switzerland, plastic pipelines have found a novel use for conveying milk from high alpine pastures down to the villages for manufacture into cheese (*D.S.A. 17*, 929 *c*, *18*, 644 *b*, 834 *c*).

125. *Immersion cleaning.* The development and adoption of immersion cleaning methods seem to be going hand in hand with the increased use of yard-and-parlour milking systems. Immersion cleaning is claimed to be easier and cheaper than conventional methods of cleaning milking equipment and, bacteriologically, it has given good results. Immersion cleaning is, however, only suitable for stainless steel and rubber surfaces and its use is impractical for large pieces of equipment. The cleaning technique consists of pre-rinsing the equipment free of milk using dilute hypochlorite solution, storing it in a 2% caustic soda solution between milkings, and rinsing again just before assembly. A later report states that where hard water is used, the deposition of calcium soap and inorganic calcium salts can be avoided by adding ethylene-diaminetetra-acetic acid to the immersion solution (*D.S.A. 18*, 41 *c*, 42 *a*, *b*, 908 *c*).

126. *Bulk milk handling.* Bulk milk collection continues to create a great deal of interest amongst both dairy farmers and the dairy industry in many parts of the world. Progress in bulk milk handling continues: in Scotland a third scheme was inaugurated in May, 1957; in New Zealand the dairy company that pioneered bulk collection now has 150 tankers bringing in milk, and many other companies have started bulk collection; in America 16% of all producers have bulk tanks—Central Arizona claims the record with 91·9% of producers having bulk tanks (*D.S.A. 19*, 636 *a*, 830 *d*; *20*, 120 *c*).

In Great Britain, the 5 Milk Marketing Boards have combined to do some valuable work in laying down minimum standards of design, construction and performance for farm milk tanks. Their publication "Specification for Farm Tanks" was published in 1957 (*D.S.A. 20*, 115 *c*). There has also been a considerable amount of literature on the economics, flavour and bacteriological, and engineering aspects of bulk collection.

127. *Milk treatment.* The use of ultra-centrifugation opens a new approach to the problem of removing bacteria from milk. In Belgian experiments (*D.S.A. 19*, 46 *c*) conducted on a semi-commercial scale, ultra-centrifugation destroyed more than 80% of the bacteria in bulk milk; it is considered that the process may be of value on a commercial scale in removing spores from milk intended for cheese manufacture or industrial sterilization. Promising results were obtained, especially in removing spores from skim-milk and whole milk in Sweden and Germany respectively (*D.S.A. 19*, 47 *a*, 755 *c*). The Swedish workers had less success with whole milk, and they also pointed out the considerable loss of milk solids entailed. The German workers noted a decrease in efficiency with prolonged running. It appears that a considerable amount of further work is necessary.

Studies on the sterilization of milk by ionizing radiations have continued at several laboratories, chiefly in the U.S.A. It is well known that milk can be sterilized by ionizing radiations but the off-flavour resulting from this treatment tends to make the product unpalatable. At the Massachusetts Institute of Technology, this problem has been overcome by using a distillation process to remove the flavour, but work has so far been done only on a laboratory scale (*D.S.A. 19*, 97 *c*). Nutritive and chemical aspects have been studied at Illinois and Pennsylvania respectively (*D.S.A. 18*, 1043 *d*; *20*, 77 *a*) but in spite of considerable progress, the commercial application of radiation treatment still seems a long way off.

128. *Deep-frozen milk.* An important development in the manufacture of frozen milk has been reported from the National Institute for Research in Dairying, Shinfield. The main feature of the new process lies in the use of ultrasonic vibrations; pasteurized milk is subjected to the vibrations under carefully controlled conditions, filled into polythene containers of up to 1-gal. size, frozen to a temperature of 5°F. and stored below 10°F. The process appears to overcome difficulties with fat separation and protein precipitation on thawing that were experienced in earlier processes. The product has been stored satisfactorily for 12 months. On thawing, its physical properties and consumer quality are said to be indistinguishable from those of freshly pasteurized milk. The work was carried out as the result

of requests received from shipping companies for liquid milk which would keep fresh during long sea voyages to India, Australia and New Zealand. The process has also been successfully applied for freezing cream, and in this field it is likely to find wider commercial application (*D.S.A. 19*, 808 *a*).

During recent years there have been many papers on the manufacture and storage of frozen milk and cream; a comprehensive review was recently published in *Dairy Science Abstracts* (*D.S.A. 19*, 875, 973).

129. *Instant Milk.* Instant milk, a dried milk which dissolves rapidly and completely in water, is now firmly established in various parts of the world where insufficient supplies of liquid milk are available. Since the previous C.A.B. report, scientific studies of Instant milk have become increasingly numerous. A fundamental study of the chemical and physical changes taking place when Instant milk is dissolved, was carried out in California. Results indicate that the 'wettability' of Instant milk is largely due to the reorientation of salts and lactose to provide rapidly soluble components on the particle surface (*D.S.A. 19*, 509 *c*). Australian workers have pointed out that the 'Instantizing' process is carried out under conditions which favour the Maillard or browning reaction between lactose and milk protein. This reaction, which tends to give a browning effect and an objectionable off-flavour, is the major cause of deterioration in dried skim-milk (*D.S.A. 19*, 154 *d*). Nutritive properties of Instant milk were studied in rat growth trials; no loss occurred in the nutritive value of the protein even in samples that had been stored for 2 years (*D.S.A. 19*, 749).

130. *Buttermaking.* As continuous buttermaking processes have not met with the success generally expected of them various attempts have been made to streamline and mechanize the conventional process.

A system for pumping butter direct from the churn to the cask or packing machine was developed in Denmark some years ago; it eliminates the laborious and somewhat unhygienic task of emptying butter from the churns onto trolleys. Reports on this method include a detailed description of the pump and its operation; difficulties encountered with its operation in Sweden; and a report of its successful use in Germany (*D.S.A. 18*, 822 *a*; *19*, 283 *d*; *20*, 205 *b*).

The design of butter churns has received some attention. Various churns of advanced design have appeared on the market; one of these, the Danish 'Top' churn, was described in a recent paper. This churn consists of a stainless steel cylindrical barrel with tapered bottom and convex top. It has no roller or beating element and is cleaned by the circulation of detergents sprayed over the inside surface by a turbine at the rounded end (*D.S.A. 19*, 553 *f*).

A new machine for packing butter has been reported from New Zealand. The machine is operated entirely by compressed air and vacuum; it receives 56 lb. blocks of butter direct from a bulk packer and deals with all the operations from wrapping and cartoning to glueing and sealing of the carton (*D.S.A. 20*, 112 *a*).

131. *Cheese.* The mechanization of the cheesemaking process continues to be one of the industry's chief problems. The Australian workers who developed the short-time process of Cheddar cheesemaking described in the previous C.A.B. report have now designed a machine which will mechanize the cheddaring stage (*D.S.A. 18*, 823 *a*). Full details and illustrations of this machine were presented recently (*D.S.A. 19*, 625 *d*). Trials with a prototype of the machine were carried out at the dairy laboratories of C.S.I.R.O. in Melbourne; results appear to be promising. The blocks of curd produced by the machine were of close-texture and good structure. One unit of the machine will deal with 600 lb. curd per hour. It is possible to envisage a complete mechanization of the cheddar cheesemaking process by using this machine in conjunction with a Steinecker type cylindrical vat and hooping equipment. Other mechanized systems of cheesemaking have been described in an American patent and in a paper by an English worker (*D.S.A. 19*, 814 *a*, *20*, 112 *c*).

Perhaps the work of most outstanding value to the cheese industry has been the development of a phage resistant medium (P.R.M.) which will prevent the multiplication of phage but allow starter culture to grow normally. P.R.M. has already been made available commercially in the form of a spray-dried powder. A report on the commercial use of P.R.M. has come from Australia. Although some difficulties were encountered (including air-borne phage infection), results were generally encouraging (*D.S.A. 19*, 134 *d*, 940 *a*).

New developments in surface treatment and packaging of cheese have evoked interest in the industry. 'Foodplast', a synthetic resin emulsion which is painted onto the cheese 3-8 days after brining, has been used for surface treatment; the film allows the normal escape of gases and moisture into the atmosphere. Its use is claimed to result in reduced mould growth, reduced weight losses, improvement of rind-formation, economy of labour and general hygienic protection. Some, but not all, of these claims have been substantiated in various

studies in Switzerland, Sweden and the Netherlands (*D.S.A. 19*, 718 *e*, 815 *b*; *20*, 23 *a*, *b*); more work needs to be done before the value of the product can be finally evaluated.

The value of various cheese packing materials, especially plastics, has been compared for (i) domestic storage of cut portions of cheese, (ii) pre-packing Cheshire and Cheddar cheese, (iii) ripening Cheddar and Cheshire cheese at 54-55°F (*D.S.A. 19*, 545, 719 *b*, *c*, 720 *a*).

Reports from Australia and Sweden show some satisfactory results with the use of Cryovac for cheese packaging (*D.S.A. 20*, 22 *a*, *b*).

Helminthology

132. The entry of F.A.O. and W.H.O. into the helminthological field is revealing to many governments the extent of helminth diseases in their several countries and the insidious role which chronic and subclinical infections are now playing, and are likely to assume increasingly in the future, in preventing the full economic development of their agriculture and in undermining the health of their communities. Groups of technical experts who have recently studied some of the problems have reported on their complexity. These reports have imported a new angle of urgency to their examination which is reflected in the efforts of several of the great pharmaceutical firms to produce new, more potent and less toxic anthelmintics which can be used in mass treatment campaigns and new chemicals for the destruction of helminth vectors, but there is no easy solution owing to the multiplicity of parasite species which occur in individual hosts, and of their vectors and reservoir hosts.

133. *Anthelmintics.* Phenothiazine has now established itself as a gastro-intestinal anthelmintic for some of the more important nematodes of sheep and cattle. Recent investigations have shown that its remedial efficacy can be increased and the remedial dosage correspondingly lowered by reducing the particle size to under 30μ although this is not important in prolonged dosing as a prophylactic. The oral administration of Lucanthone (Miracil) is tending to replace the intravenous injection of tartar emetic in mass campaigns against schistosomiasis. *Nematodirus* spp. in sheep has hitherto proved resistant to treatment but two new and very effective remedies have recently been announced almost simultaneously, viz., Bephenium embonate and n-butyl N-phenyldithiocarbamic acid; the latter is also outstanding in its activity against *Ascaridia galli* in chickens. Of the several antibiotics tested, Hygromycin has been shown to be potent against *Ascaris* in pigs, and oxytetracycline is a recent introduction for *Enterobius* in man. Another new remedy is 3-methyl-1-pentyn-3-yl sodium phthalate for whipworm in dogs. Although cadmium compounds have been shown to be effective ascaricides it is unlikely that they will displace piperazine owing to their toxicity.

134. *Vermifuges.* This old and formerly loosely-used term for remedies which do not kill but bring about the evacuation of helminths has again come into current scientific use for new remedies. Piperazine is now replacing sodium fluoride as the remedy of choice for *Ascaris* in pigs and is equally effective against oxyurid infections in man and other mammals. Mepacrine hydrochloride is now widely used as a vermifuge for tapeworm infections in man and halogenated hydroxydiphenylmethane, known for its germicidal properties, has also been found to be very active in the dog. The treatment of lungworms, widespread in many countries and the cause of severe losses in cattle and sheep, has heretofore proved very unsatisfactory but the discovery that cyanacethydrazide, a drug used by physicians in the treatment of pulmonary tuberculosis, has a remarkable vermifugal action on the adults of those lungworms which inhabit the bronchioles of herbivores may prove to be the most important contribution of recent years.

135. *Molluscicides.* It looks as if copper sulphate for the destruction of molluscan vectors may soon be replaced by pentachlorophenol, which is not so readily neutralized in certain types of water, unless on further research one of the abietylamines, now used in large quantities as an algicide proves more effective. It is readily available and relatively low in cost.

136. *Pasture Management.* The complexity of the natural factors controlling the infective larvae of gastro-intestinal nematodes on pastures is only now being fully realized. Climatic conditions differ so widely in different parts of the world that the problem of control of intestinal infections requires specialized local studies, such as those effected in Australia, England and the U.S.A., before animal husbandry can be correctly adjusted to local circumstances.

137. *Irrigation.* Experience in Egypt, Australia and Iraq has drawn attention to the spread of helminth infections which inevitably follows the artificial irrigation of land. It is now admitted that in planning new irrigation works the engineer must collaborate with the parasitologist and that the parasitologist can contribute useful advice on the adjustment and reconstruction of established schemes. In the Chinese Republic a vast programme of molluscan eradication is being carried out by the farming community in collaboration with scientific experts.

138. *Geographical Distribution.* Additions continue to be made to the known geographical distribution of helminths but more detailed information is required concerning the extensity and intensity of those of stock in each country. Experts from F.A.O. have just completed such surveys in the Federation of Rhodesia and Nyasaland and in Iraq. Until recently the root-knot eelworm was unknown in Ghana. It has now been found in many edible plants. In Rhodesia a large number of plant-parasitic eelworms have been recorded for the first time. In Maryland plant-parasitic nematodes constitute a major problem in crop growth. Additional evidence has been forthcoming that free-living nematodes can cause considerable damage, especially in the U.S.A. as ectoparasites on the roots of vines and fruit trees. In Peru a root-disease complex causes serious effects and death in cotton, resistant varieties becoming susceptible after attack by large numbers of *Meloidogyne incognita* var. *acrita.*

139. *Life-histories.* Many of the life-histories of helminths which have been elucidated are of scientific interest only, and of these the two most unexpected results are (*a*) that although ostracods are known intermediaries for certain tapeworms, *Cypridopsis vidua* has now been found for the first time to serve as the second intermediate host of a trematode, *Halipegus occidualis*, and (*b*) the formation of miracidia in trematode daughter sporocysts. Among new observations of more practical interest are (*a*) the roundworm of calves, *Neoascaris vitulorum*, is normally acquired through the placenta, (*b*) the migrating larvae of *Toxocara canis* of the dog causes eosinophilic lung and granulomata in other organs in man and in the pig, (*c*) the normal migration of *Toxocara canis* differs fundamentally from that of *Ascaris suum* in the pig, and (*d*) the filarial species *Wuchereria malayi*, long regarded as a parasite peculiar to man, is also widely prevalent as a natural infection in cats and dogs in Malaya. This important discovery undermines the significance of statistical data of the incidence of infective larvae obtained by dissection of wild mosquito vectors, hitherto used as an indication of the progress and success of antifilarial campaigns. (*e*) The environmental factors determine whether the embryos of *Strongyloides* develop in the soil directly into infective larvae or first into adult males and females which then produce the infective larvae. (*f*) The claim that a palm weevil is the vector of the eelworm *Aphelenchoides cocophilus*, the cause of red ring disease in coconuts in the West Indies, is now in question and is being investigated by a team composed of a botanist, an entomologist and a helminthologist.

140. *Host-parasite Relationships.* Traditionally, helminthology is a descriptive discipline but nowadays it necessarily includes experimental physiology and immunology for which special training is required. An increasing number of papers are appearing which deal with the metabolic products and nutritional requirements of different helminths at each specific stage of growth. Special methods of *in vitro* culture are constantly under review. It is hoped that chemical analysis of metabolic products will provide a more scientific basis for chemotherapy, aid in the production of more specific antigens for diagnosis and afford a clue to host resistance to infection. That the irradiation of larvae can inhibit their growth to sexual maturity and that the injection of larvae so treated can protect the host from subsequent infection opens up an entirely new field of research.

141. *Genetics.* Although in some instances host susceptibility to helminth infection appears to be inherited, the evidence is conflicting. This subject is still largely ignored but Dutch geneticists are attempting to produce a marketable potato resistant to the eelworm *Heterodera rostochiensis* by crossing commercial varieties with resistant wild species indigenous in South America: so far their efforts have not been successful.

142. *Taxonomy.* A major contribution to systematic helminthology is the publication by the Academy of Sciences of the Soviet Union of a series of memoirs on the classification of the Nematoda and Trematoda. A similar series on the Cestoda has been commenced.

From current literature it now seems certain that there are several distinct strains of *Schistosoma japonicum* in domesticated animals and man in China and Japan and that the strain in dogs in Formosa is incapable of infecting man. The common stomach worm, *Haemonchus contortus*, has been shown to differ morphologically in cattle and in sheep. It is also claimed that *Schistosoma haematobium* of North Africa and that of South Africa are different and the name *Schistosoma capense* has been revived for the South African species. A human parasite in West Africa has hitherto been wrongly identified as *Paragonimus westermanii*, a lung parasite of carnivores and man in the Far East. A vast number of helminths from many different animals have recently been named as new species, in some instances on slender grounds and in other cases without due regard to the International Rules of Zoological Nomenclature.

143. *Reservoir Hosts.* In Africa and in South America, *Schistosoma mansoni* has been found as a natural infection in rodents.

144. *New Periodicals.* The difficulty of securing publication of helminthological articles has been to some extent relieved by the issue of the two new journals, *Experimental Parasitology* in the U.S.A.

and *Nematologica* in Holland, but the need for further facilities is indicated by the large number of original contributions which are published only in abstract with the result that much detailed scientific data is lost to science.

Horticulture and Plantation Crops

145. Progress is more noticeable in detail than in the overall picture. The general picture is attempted in the first three notes that follow. Some of the details are then sketched in.

146. *Growth and reproduction.* From studies on such diverse types of plant as the tomato, the strawberry, the apple, the vine and the tea bush, there appear to be emerging certain patterns or rhythms of growth which may be common to all of them. Thus there is evidence that vegetative growth and root growth tend to occur in alternating waves, and that the various reproductive phases are superimposed on, and compete with, these alternating phases. As yet, the picture is in some respects rather hazy, possibly because many workers fail to distinguish quite clearly between the process of inflorescence initiation and that of inflorescence or flower bud development. The need for this distinction is evident from work on such plants as the olive, the grapevine and the garden pink. For each of these plants one set of factors is needed to "trigger off" the initiation of primordia and a quite different set to promote the subsequent development of the flower buds. In general, the external factors which appear very largely to control patterns of growth and reproduction are water, temperature and light (duration or intensity).

147. As to internal factors, it has been suggested, mainly by Russian workers, that the factor which governs the start of the reproductive phase in the apple and other fruits is the cell sap concentration. It remains, however, to be seen whether this is cause or effect. Plants such as tomatoes and tobacco show marked seasonal variations in their capacity to absorb water and such nutrients as phosphates, and deciduous fruit trees also display a capacity to vary their uptake of water at different times of the growing season. A clarification of the relationships between growth phases and variations in absorptive capacity is desirable.

148. *Plant nutrition.* An interesting development has been the use of various systems of survey to determine what might be termed generalizations concerning the nutrient needs and responses of crops. The collective re-analysis of the results of many fertilizer trials on sugar cane grown under a wide range of conditions provides one example. Another is the establishment of hundreds, even thousands, of simple trials throughout a region; here again sugar cane has received attention, but the most ambitious scheme so far encountered concerns coconuts in India. Finally, leaf analysis surveys in apple and citrus orchards have helped to throw light on the critical levels of certain elements, below which tree growth and cropping will suffer.

149. Foliar diagnosis is, however, not a straightforward business. Work in many countries and on many crops has shown that the mineral composition of leaves may vary markedly with age, position, exposure to light and even with the time of day the samples are taken. Composition may also vary with growth phase, crop load and season. Superimposed on all this is the problem of antagonism between elements, as between potassium and magnesium, and partial interchangeability between others, e.g. potassium and sodium. Finally, there are problems of analysis, which may arise when deficiences of one or more elements are so acute as to depress the dry matter content, as may be seen in the leaves of apple trees suffering from acute manganese deficiency.

150. No wonder other methods of approach have been sought. They include the use of nutrient balances or cation : anion ratios to interpret nutrient status in cacao, coffee and hevea trees, the analysis of roots and stems to determine some elements and of leaves or petioles to determine others, and an examination of the organic nitrogen compounds in the tracheal sap of apples and other plants in an effort to find a more reliable guide to their nitrogen status.

151. Among surprises is the observation that under some conditions of storage urea may break down to produce a toxic compound, biuret. Injury caused by biuret has been recorded on citrus and pineapples, but it is not impossible that some of the cases of urea toxicity recorded earlier on apples and other crops were due to this.

The trace element deficiency due to lack of iron has always been one of the most difficult to cure. Considerable interest was, therefore, aroused a few years ago when Florida workers described the curing of iron chlorosis in citrus trees with soil applications of very small quantities of iron chelated with a compound now generally known by the initials EDTA. The iron deficiency in this case, however, was due to the presence of excessive amounts of copper and other heavy metals. When the same treatment was applied to citrus and ornamental crops in California suffering from the commoner lime-inducing chlorosis results were generally disappointing. Since then other iron chelates have been developed, some of which have corrected iron deficiency caused by excess lime. Chelates of other metals have also been tested, with varying results.

152. *Plant protection.* The fact that most perennial crops are propagated vegetatively makes it of particular importance to ensure that the planting material used should be "virus-free", or rather "free from known virus diseases". Failure to do this may not only jeopardize commercial crops, but may seriously increase the degree of error in field experiments. The first step in obtaining healthy planting material is to ensure that the parent source is itself healthy. This is not easy. Some virus diseases are slow to develop symptoms, others, such as the ratoon stunting disease of sugar cane, produce no outward symptoms but merely reduce growth and yield, and yet others, such as tristeza disease of citrus, only develop symptoms in certain species or in certain combinations of rootstock and scion.

153. Much attention has, therefore, been paid to methods of detecting virus diseases in plants. These have included chemical and serological tests and the use of indicator plants which will develop readily identifiable symptoms when inoculated with sap from the plant to be tested. With several fruit crops sufficient progress has been made with indexing techniques to permit the establishment of schemes for producing root-stocks, budwood and other planting material that are "free from known virus diseases". Among other methods of control, heat treatment has been outstandingly successful in ridding sugar cane setts of the ratoon stunting virus and has also proved of value in obtaining small quantities of clean material of a limited number of other plants. The discovery that in some cases there is an appreciable time lag in the spread of a virus disease from older parts of a plant to young shoots has been put to good use in such crops as dahlias, where healthy new stock has been raised from tip cuttings.

154. In the control of other diseases and pests various solid achievements can be recorded, such as the use of antibiotics for the control of bacterial diseases, notably fireblight of pears, the application of low volume techniques to control banana leaf spot disease with small amounts of oil, the use of fumigants to prepare seed beds for tobacco and other crops and in the development of nematicides which can be used among living plants such as citrus trees.

155. Fundamental work which appears to offer future reward concerns the production by plants such as the apple of polyphenolic metabolites possessing fungistatic properties, or again the effects of spray chemicals on plant growth, composition and anatomy.

156. *Control of environment.* The year 1957 saw the publication of the first full account of the work of the Earhart Plant Research Laboratory in California by Professor Went. The establishment of this Institute marks a new era in research facilities. For the first time it has been possible to control every environmental factor which may or may not affect plant growth.

157. The work, essentially fundamental, has nevertheless already shown the way, not only to the establishment of similar, though considerably less ambitious, laboratories in England, Belgium, Holland and elsewhere, but also to its practical value in commercial horticulture. Thus exploitation of the principles of photoperiodism by the conditioning of glasshouses has been one of the chief factors in increased chrysanthemum production and the establishment of the chrysanthemum as the most valuable cut flower in Canada.

158. The basic idea of controlled environment has gripped the imagination and the trials of Hudson and other European workers show the far reaching implications of the work for all glasshouse crops. Hudson in a recent publication *Control of Plant Environment for Experimental Work* (Misc. Publ. Univ. Nottingham Dep. Hort. 8) paves the way for expansion by a brief, clear account of the principles involved and of the actual types of controlled environment concerned, growth cabinets, temperature controlled rooms, growth rooms and glasshouses. (Hort Abstr. 27:1034, 1866, 2078; 28:975, 976, 980).

159. *Time and work studies.* A recent feature is the rising interest in the economic management of horticultural labour. The Bureau of Horticultural Economics at Alnarp. Sweden, was the first to publish indications of the account of labour economically ideal for various horticultural operations in the open and under glass. Similar time and work studies on prune harvesting, melon harvesting, grape packing, planting tobacco and the planting out of tomato and celery are reported from California. English publications are to hand from Wye on the general economics of horticulture, from Reading on the measurement of labour productivity in fruit and vegetable farms and from the Nottingham School of Agriculture on the economic use of labour in vegetable production. (For refs. to work in Scandinavia see Hort. Abstr. 25:3423, 4184, 26:1386, 2762, 2763, 27:4, 71, 420: in U.S.A. H.A. 25:3590, 3591, 26:2876, 3750, 3804, 27:3564, and U.K. H.A. 25:3422, 26:4292, 27:2011, 28:393).

160. *Hormones for cultural purposes.* More and more growth substances and their mode of action and interrelationships with light and other factors are being investigated. Their uses are legion, e.g., to defoliate nursery stock, to reduce disease incidence, to induce and prolong dormancy, to induce flower bud formation, to advance, delay or stimulate flowering, to influence frost resistance, to enhance colour in apples, to thin, induce set and affect size in

flowers and fruits, to control fruit drop and to influence storage life.

161. As selective herbicides they are putting the hoe and other herbicides out of action. Their herbicidal action depends on the nature of the plant's own enzymes. Thus if the non-poisonous MCPB is taken up by certain kinds of plants, including numerous noxious weeds, it is broken down to the poisonous MCPA within the plant, which is thereby destroyed. Certain crop plants, such as peas and clover, however, cannot effect this transformation and so remain unharmed.

162. The present king pin of potentially beneficent growth substances is undoubtedly gibberellin. In trials to date it has been found to elongate stems, break apical dominance, induce flowering especially in biennials which have not had their requisite exposure to cold, increase fruit set and break dormancy in seeds and tubers. It has been tried on sugar cane, pineapple, tobacco and hemp with surprising results. Most recently in California it has been under trial as a substitute for fruit thinning in Thompson Seedless grapes, the resulting fruit bunches being 50% larger than normal and the grapes twice as long and slightly broader than those from untreated clusters and showing increased sugar and decreased acid content. Studies of its unusual powers continue. (Stencilled bibliography 3273.)

163. *Mist propagation.* Few technical developments have received so much attention in recent years as this method of rooting cuttings in a fine continuous or intermittent spray, which keeps the leaf surfaces covered with a film of water. In the last 5 years the method has with various adjustments been successfully tested in the United States and elsewhere on a wide range of horticultural plants. Various methods, nozzles and media have been tested and adaptations have been made for use in propagating boxes, frames and plastic tents or chambers. It has been successfully adapted to water culture.

164. Numerous rooting media have been found adequate, e.g., coarse uniform-grained sand where water is not calcareous, a mixture of "pea grit", coarse sand and granulated peat, vermiculite and others.

165. Two basic types of piping arrangement are now used, viz., (1) an overhead system in which both pipes and nozzles are suspended over the propagating bench and (2) the in-bed system, in which the main pipe is placed on or beneath the rooting medium and the nozzles are located on upright pipes. The most suitable type of nozzle is one which produces as fine a mist as possible with the minimum delivery of water needed to produce a high R.H. and maximum coverage. Interrupted mist is controlled by a time clock which is the simplest and cheapest control, an electronic leaf, a solar mechanism, or an atmometer. The electronic leaf was suggested by Templeton and developed by Snyder and Hess in the U.S. Variations of the type have recently been developed in England. In a solar mechanism, the amount of mist is controlled by the light intensity. In the Livingston atmometer the action depends on alternate evaporation from and absorption of water by a hollow, porous clay globe.

166. Most tropical crops respond well. In Trinidad mist propagation of cacao cuttings has become a useful supplement to the closed bin method, and the problem of acclimatizing the plants to a lower relative humidity has been overcome. (Digest in preparation.)

167. *The ubiquitous plastic.* Modern plastics, especially polyethylene and polyvinyl chloride, which are light in weight but tough, resist corrosion, are flexible and easily fabricated, yet in many ways more durable than steel or glass are being increasingly used for many horticultural purposes.

168. Thin plastic films are used for protecting plants, even small trees, from frost or excessive rain. They are also used as a soil covering during steam sterilization. Black plastic film makes a valuable mulching material which suppresses weed growth and conserves soil moisture. Plastic film containers are used for packaging a multiplicity of products from the nursery seedling to the fruit ready for market. The transparent nature of the film and the ease with which it can be sealed makes it a valuable protective material which resists drying out and enhances the appearance of the product.

169. Plastic film has proved of immense value in plant propagation and is used for seed box covers, for wrapping cuttings and marcots rendering watering unnecessary and enabling the developing roots to be seen. Somewhat tougher film is replacing glass in glasshouse construction, in propagating frames and, especially, for cloches. Its light weight means that lighter and cheaper framework can be used.

170. Polythene is also manufactured as piping which is largely replacing rubber hose, being lighter and more lasting, and as underground water piping is easier to lay than metal pipes and is never fractured by frost. Drilled plastic pipes are useful for overhead sprinkling and plastic is also used for lining irrigation canals.

171. Lighter and more durable containers of all sorts from plant pots to buckets and jars for holding fertilizer concentrate in trickle irrigation systems are made from plastics and have proved superior to those made from traditional materials.

172. Finally, a new use for plastic substances is being sought in the soil itself, as a rooting medium and for modifying soil structure.

173. *Bulk harvesting.* The bulk handling of apples, citrus fruits and cherries from tree to packing house is a notable recent innovation based on initial experiments in New Zealand and the United States. Attention is also being given to the bulk harvesting of pears, peaches and wine grapes.

174. The essential feature of bulk harvesting is the elimination of the field box and its replacement by bins which may contain from 20 to 80 bushels, into which the pickers deposit the fruit straight from the tree. The bins may be transported on trailers, but pallet handling by fork-lifts attached to farm tractors has become very popular. Emptying may be by tipping, by inversion or by dumping into water. Water filled tanks are being used to transport cherries, and water aids the handling of lemons and peaches.

175. Bulk harvesting has brought about a considerable reduction in harvesting costs, mainly savings on the purchase, repairs and handling of field boxes, and, contrary to what one might expect, a noteworthy reduction in bruising and other damage due to frequent handling in field boxes. (Digest in preparation.)

FINANCE

176. The Comptroller and Auditor-General has audited the accounts of the Institute of Entomology, the Mycological Institute and the Bureaux for 1957-58. These accounts are attached to this report. The position as regards contributions on 31st March, 1958, was as follows:

(1)	Contributions due in 1957–58 (2)	Outstanding on 31.3.57 (3)	Total due (4)	Outstanding on 31.3.58 (5)	Total received in 1957–58 (6)
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Institute of Entomology	47,475 0 0	47 12 0	47,522 12 0	416 4 0	47,106 8 0
Mycological Institute	41,778 0 0	43 15 0	41,821 15 0	366 0 0	41,455 15 0
The Bureaux	163,314 0 0	218 15 0	163,532 15 0	3,614 13 0	159,918 2 0

NOTES:

(i) The figures in column (2) are those recommended by the Review Conference 1955 (page 48 of the report).

(ii) The figures of receipts in column (6) agree with the amount shown in the audited accounts on pages 39-41.

(iii) The figures in column (3) do not agree with the figures shown in column (5) of the 28th Annual Report. As reported in note (iv) of paragraph 195 of the 28th Annual Report, £218 15*s.* 0*d.* was received by the Bureaux, £47 12*s.* 0*d.* by the Institute of Entomology, and £43 15*s.* 0*d.* by the Mycological Institute, after the close of the year. These amounts received are shown in column (3) above. The balance of £915 5*s.* 0*d.* from column (5) of the 28th Annual Report (£596 17*s.* 6*d.* Bureaux, £199 Entomology and £119 7*s.* 6*d.* Mycology) still outstanding from the Colonial Territories has been taken out and will be recorded as a note under "Finance" in each succeeding Annual Report like the sum under note (iv) below.

(iv) An amount of £6,028 13*s.* 5*d.* reported in note (iii) on page 38 of the 24th Annual Report is still outstanding.

(v) The outstandings in column (5) are from Canada, Ghana and the Colonial Territories, but since the close of the year payments of £3,598 7*s.* 0*d.* to the Bureaux, £411 3*s.* 0*d.* to the Institute of Entomology and £361 15*s.* 0*d.* to the Mycological Institute have been received.

177. *Commonwealth Institute of Biological Control.* At the time of going to press, the account for the Institute of Biological Control for the year 1956-57 was still in the hands of the auditors. Copies of the audited account will be forwarded to all contributing Governments as soon as it is received and it will also be included in the Executive Council's 30th Annual Report for the year 1958-59.

178. In previous annual reports the expenditure in the account of the Bureaux Fund was classified under the Bureaux, Secretariat, Central Sales Branch, etc. The Executive Council decided that although this presentation was of interest and should be recorded, it would be of more interest to have payments on the account classified under the budget heads of the sanctioned estimates, i.e., Salaries and Maintenance heads. This would also bring the presentation of expenditure in the account of the Bureaux Fund into line with the existing presentation of expenditure in the other three accounts: Institute of Entomology, Mycological Institute and Institute of Biological Control.

This change has therefore been made in the audited accounts of the Bureaux Fund on page 39. So as to retain the records of the total expenditure between the Bureaux, Secretariat, Central Sales Branch, etc., the information is given below—

	£	s.	d.
Commonwealth Bureaux:			
Animal Breeding and Genetics (Edinburgh)	15,705	19	7
Animal Health (Weybridge)	19,705	19	4
Animal Nutrition (Aberdeen)	13,859	6	3
Dairy Science and Technology (Shinfield)	13,555	8	9
Forestry (Oxford)	19,036	10	4
Helminthology (St. Albans)	12,007	10	2
Horticulture and Plantation Crops (East Malling)	16,334	5	4
Pastures and Field Crops (Hurley)	19,510	19	10
Plant Breeding and Genetics (Cambridge)	15,296	10	6
Soils (Rothamsted)	17,439	8	0
Secretariat	14,871	11	10
Central Sales Branch	13,437	13	9
Contributions to National Institute of Agricultural Engineering (Silsoe)	3,000	0	0
	£193,761	3	8

Statements of Accounts

(Pages 39 – 41)

THE EXECUTIVE COUNCIL OF THE COMMONWEALTH AGRICULTURAL BUREAUX

ACCOUNT OF RECEIPTS AND PAYMENTS FOR THE YEAR ENDED 31ST MARCH, 1958

RECEIPTS

	£ s. d.	£ s. d.
Contributions from Commonwealth and other participating Governments for:		
Commonwealth Agricultural Bureaux	159,918 2 0	
Various Institutes	124,396 18 0	
	284,315 0 0	
Less: paid over to Institutes	124,396 18 0	159,918 2 0
Sale of publications		45,017 19 1
Contributions from Institutes towards cost of Headquarters		3,000 0 0
Miscellaneous receipts:		
Dividends and Interest	4,182 10 7	
Rent of Farnham House flat	36 0 0	
Other receipts	109 12 6	
		4,328 3 1
		212,264 4 2
Sale of securities:		
£12,000 Conversion Loan 4% Stock, 1957-58 (*less* interest included above)		11,950 1 0
Redemption of securities:		
£50,000 Exchequer 5% Stock, 1957	50,000 0 0	
£25,000 Treasury Bills (*less* interest included above)	24,742 14 2	
		74,742 14 2
Balance at 1st April, 1957		29,227 6 4
		£328,184 5 8

PAYMENTS

	£ s. d.	£ s. d.
Consultant Directors' honoraria		945 0 0
Secretary and Assistant Secretary, salaries		4,186 5 0
Directors and Assistant Directors, salaries		35,826 4 3
Scientific Assistants' salaries		45,559 17 2
Clerical and Technical staff		39,493 7 0
National Insurance		2,160 16 6
Superannuation		10,871 7 4
Supplementation of superannuation and increases in pensions		766 11 0
Travelling expenses		1,121 2 4
Books, periodicals, etc.		1,743 6 9
Issue bulletins and periodical publications		32,363 17 0
Stationery, postage, telephones, etc.		5,438 2 10
Rent, maintenance, etc.		5,310 0 11
Contribution to National Institute of Agricultural Engineering		3,000 0 0
Contingencies		714 0 0
Furniture and equipment (including reprinting unit)		3,464 5 7
Visits overseas (outside Europe)		763 9 3
		193,727 12 11
Purchase of securities:		
£100,000 Conversion Loan 4% Stock, 1957-58 (including £32 17*s.* 7*d.* accrued interest)		99,628 9 10
Loan:		
Buckinghamshire County Council		15,000 0 0
Balances at 31st March, 1958:	£ s. d.	
H.M. Paymaster General	16,979 14 7	
Post Office Savings Bank	807 11 11	
Sub-accountants and suspense	2,040 16 5	
		19,828 2 11
		£328,184 5 8

(Signed) G. G. HEWLETT,
Accountant to Council.

(Signed) S. HOWARD, Secretary,
Executive Council, Commonwealth
Agricultural Bureaux.

I have examined the above Account. I have obtained all the information and explanations that I have required, and I certify, as the result of my audit, that in my opinion the above Account is correct.

(Signed) E. G. COMPTON,
Comptroller and Auditor-General.

Exchequer and Audit Department,
27th October, 1958.

Investments at 31st March, 1958:

	Cost £ s. d.	*Market value at 31st March 1958* £ s. d.
£2,000 Commonwealth of Australia 4% Stock, 1955-70	1,940 4 0	1,660 0 0
£88,000 Conversion Loan 4% Stock 1957-58	87,673 1 5	87,560 0 0
£15,000 Buckinghamshire County Council—loan at seven days' notice	15,000 0 0	15,000 0 0
	£104,613 5 5	£104,220 0 0

COMMONWEALTH INSTITUTE OF ENTOMOLOGY

ACCOUNT OF RECEIPTS AND PAYMENTS FOR THE YEAR ENDED 31ST MARCH, 1958

RECEIPTS

	£ s. d	£ s. d.
Contributions:		
Commonwealth and other participating Governments	47,106 8 0	
Other Contributors ..	575 0 0	
		47,681 8 0
Sale of publications		14,143 17 2
Dividends and interest ..		1,006 12 9
Administration fees and agency charges:		
Pool of Entomologists ..	200 0 0	
Termite Research Unit ..	75 0 0	
African Phytosanitary Commission	1,105 14 1	
		1,380 14 1
		64,212 12 0
Balance at 1st April, 1957 ..		5,893 14 4
		£70,106 6 4

PAYMENTS

	£ s. d	£ s. d.
Directors' Salaries		4,767 2 10
Scientific Assistants' Salaries		26,619 12 2
Clerical and Technical staff		8,003 17 10
National Insurance		588 0 0
Superannuation		3,801 0 3
Supplementation of superannuation and increases in pensions		1,275 10 6
Travelling expenses		17 15 8
Books, periodicals, etc.		375 15 4
Issue bulletins and periodical publications		8,770 19 2
Stationery, postage, telephones, etc.		684 0 10
Rent, rates, insurance, maintenance, etc.		647 15 7
Lighting, heating, water, cleaning, etc.		419 8 0
Contribution to Headquarters, audit fee and contingencies		1,175 2 7
Furniture and equipment		397 1 10
		57,543 2 7
Balances at 31st March, 1958:		
Crown Agents for Oversea Governments and Administrations	632 5 3	
Petty cash and stamps	6 10 4	
Joint consolidated fund	11,000 0 0	
F.S.S.U. Suspense	960 15 5	
	12,599 11 0	
Less: Miscellaneous Suspense	36 7 3	
		12,563 3 9
		£70,106 6 4

Investments at 31st March, 1958:

£ s. d		Cost £ s. d	Market value at 31st March, 1958 £ s. d
1,000 0 0	Cyprus 4% Stock 1956/66	950 0 0	810 0 0
2,679 19 0	Funding Loan 4% Stock 1960/90	1,869 12 6	2,331 11 2
1,017 16 8	Kenya 4½% Stock 1961/71	998 15 0	839 14 3
1,000 0 0	Nigeria 4% Stock 1963	881 7 0	870 0 0
951 1 10	Savings 3% Bonds 1960/70	1,040 5 2	727 11 9
3,000 0 0	N. Rhodesia 3% Stock 1963/65	2,911 1 7	2,385 0 0
2,000 0 0	War Loan 3% Stock 1955/59	2,035 0 0	1,950 0 0
2,060 17 1	Savings 3% Bonds 1955/65	2,126 15 1	1,782 12 9
1,013 18 2	Nyasaland 4½% Stock 1971/78	1,000 13 3	795 18 4
		£13,813 9 7	£12,492 8 3

(Signed) G. G. HEWLETT, Accountant to Council.

(Signed) E. O. PEARSON, Director.

I have examined the above Account. I have obtained all the information and explanations that I have required, and I certify, as the result of my audit, that in my opinion the above Account is correct.

(Signed) E. G COMPTON,
Comptroller and Auditor-General.

Exchequer and Audit Department,
22nd October, 1958.

(Signed) S. HOWARD, Secretary,
Executive Council,
Commonwealth Agricultural Bureaux.

COMMONWEALTH MYCOLOGICAL INSTITUTE

ACCOUNT OF RECEIPTS AND PAYMENTS FOR THE YEAR ENDED 31ST MARCH, 1958

RECEIPTS

	£ s. d.	£ s. d.
Contributions:		
Commonwealth and other participating Governments	41,455 15 0	
Other contributors ..	2,335 0 0	
		43,790 15 0
Sale of publications		10,780 14 1
Sale of cultures		643 5 9
Rent of acquired property ..		745 6 7
Dividends and interest ..		1,066 5 6
Administration Fees and Agency Charges:		
Pool of Plant Pathologists	802 18 3	
African Phytosanitary Commission	1,625 11 2	
		2,428 9 5
		59,454 16 4
Instalment of contribution towards cost of building completed in 1955 ..		51 0 0
Sale of securities:		
£41 14s. 8d. Conversion Loan 4% Stock, 1957/58 ..		41 17 0
Redemption of securities:		
£5,000 Treasury Bills (*less* interest included above)	4,950 4 2	
£5,000 Exchequer 5% Stock, 1957	5,000 0 0	
		9,950 4 2
Balance at 1st April, 1957 ..		9,611 13 6
		£79,109 11 0

PAYMENTS

	£ s. d.	£ s. d.
Director's salary		2,441 13 4
Scientific Assistants' salaries		19,341 19 3
Clerical and Technical staff		9,764 7 9
Part-time staff		921 1 8
National Insurance		575 13 7
Superannuation		2,812 2 11
Supplementation of Superannuation and Increases in Pensions		406 11 7
Travelling expenses		61 9 6
Books, periodicals, etc.		270 5 10
Issue bulletins and periodical publications		6,978 19 1
Stationery, postage, telephones, etc.		726 1 5
Rent, rates, insurance, maintenance, etc.		1,285 9 5
Lighting, heating, water, cleaning, etc.		2,267 1 7
Contribution to Headquarters, audit fee and contingencies		1,169 1 9
Furniture and equipment		1,308 9 10
		50,330 8 6
Purchase of securities:		
£10,041 14s. 8d. Conversion loan 4% Stock 1957/58 (including £2 4s. accrued interest)		10,000 0 0
Balances at 31st March, 1958:		
Crown Agents for Oversea Governments and Administrations	83 18 8	
Bank, petty cash and stamps	1,013 16 6	
Joint Consolidated Fund	17,000 0 0	
F.S.S.U. and Miscellaneous Suspense	681 7 4	
		18,779 2 6
		£79,109 11 0

Investments at 31st March, 1958:

£ s. d.		*Cost* £ s. d.	*Market value at 31st March, 1958* £ s. d.
2,077 15 4	New Zealand 3½% Stock, 1960/64	2,077 15 4	1,818 0 11
10,000 0 0	Conversion loan 4% Stock, 1957/58 ..	9,958 8 10	9,950 0 0
		£12,036 4 2	£11,768 0 11

(Signed) G. G. HEWLETT, Accountant to Council.
(Signed) J. C. HOPKINS, Director.

I have examined the above Account. I have obtained all the information and explanations that I have required, and I certify, as the result of my audit, that in my opinion the above Account is correct.

(Signed) E. G. COMPTON,
Comptroller and Auditor-General.

Exchequer and Audit Department,
23rd October, 1958.

(Signed) S. HOWARD, Secretary,
Executive Council,
Commonwealth Agricultural Bureaux.

LIST OF SANCTIONED STAFF, BY GRADES

TEN BUREAUX, HEADQUARTERS AND CENTRAL SALES

Secretary	*Assistant Secretary*	*Directors*	*Assistant Directors*	*Scientific Assistants*	*Executive Assistants*	*Indexers*	*Senior Clerical*	*Clerical and Typing*
1 (1)	1 (1)	10 (10)	10 (10)	54 (55)	3 (—)	7¼ (9)	11 (15)	58 (60)

INSTITUTES

	Director	*Assistant Director*	*Scientists*		*Executive Assistant*	*Preparators, etc.*		
			A/B	*C.*		*D.*	*E.*	*F/Clerical and Typing*
Entomology	1 (1)	1 (1)	12 (15)	10 (13)	—	7 (9)	3 (3)	6 (7)
Mycology	1 (1)	—	9 (13½)	8 (10)	1 (—)	2 (1)	8 (10)	13 (19)

	Director	*Assistant Director*	*Senior Entomologist*	*Scientists*			*Librarian*	*Clerical and Typing*
				A.	*B.*	*C.*		
Biological Control ..	1 (1)	1 (1)	1 (1)	2 (5)	1 (2)	5 (5)	1 (1)	3 (3)

Figures in brackets are those recommended by the 1955 Review Conference, see page 50 of the Report. This staff was not necessarily to be worked up to at the beginning of the quinquennium.

Consultant Directors are not included.

COMMONWEALTH AGRICULTURAL BUREAUX LIAISON OFFICERS

UNITED KINGDOM	W. Ness, Agricultural Research Council, Cunard Buildings, 15 Regent Street, London, S.W.1
CANADA	H. L. Trueman, B.S.A., Foreign Agricultural Relations Officer, Department of Agriculture, Ottawa, Ontario, Canada
AUSTRALIA	W. Ives, M.Ec., Commonwealth Scientific and Industrial Research Organisation, 314 Albert Street, East Melbourne, C.2, Victoria, Australia
NEW ZEALAND	N. A. Marris, M.Sc., Department of Scientific and Industrial Research, Information Bureau, P.O. Box 8018, Government Buildings, Wellington, C.1, New Zealand
UNION OF SOUTH AFRICA	P. W. Vorster, M.Sc. (Agric.), D.Sc. (Agric.), Director of Technical Services, Department of Agriculture, Private Bag 116, Pretoria, Transvaal, Union of South Africa
INDIA	M. S. Randhawa, M.Sc., F.N.I., I.C.S., Vice-President, Indian Council of Agricultural Research, Multistoreyed Building, Queen Victoria Road, New Delhi, India
PAKISTAN	Taskhir Ahmad, Ph.D. (Cantab.), Director, Department of Plant Protection, Government of Pakistan, Karachi
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COLONIAL TERRITORIES	G. W. Nye, C.M.G., O.B.E., B.Sc. (Agr.), C.D.A., Agricultural Adviser to the Secretary of State, Colonial Office, Sanctuary Buildings, Gt. Smith Street, London, S.W.1
REPUBLIC OF THE SUDAN	Chief, Agricultural Research Division, Ministry of Agriculture, Wad Medani, Republic of the Sudan
REPUBLIC OF IRELAND	C. D. Ryan, Department of Agriculture (Economic Division), Dublin

ADDRESSES

The Executive Council,
Farnham House, Farnham Royal, Bucks.
Telephone—Farnham Common 781
Secretary—Sir Herbert Howard
Assistant Secretary—E. L. Hay, M.B.E.

Central Sales,
Farnham Royal, Bucks.
Telephone—Farnham Common 781

Commonwealth Mycological Institute,
Ferry Lane, Kew, Surrey
Telephone—Richmond 4086/7
Director—J. C. F. Hopkins, D.Sc., A.I.C.T.A.,
Assistant Director—H. A. Dade, A.R.C.S.

Commonwealth Institute of Entomology,
c/o British Museum (Natural History),
Cromwell Road, London, S.W.7

Publications Office,
56 Queen's Gate, London, S.W.7
Telephone—Knightsbridge 0067/8
Director—W. J. Hall, C.M.G., M.C., D.Sc.
Director-designate—E. O. Pearson, M.A., A.I.C.T.A.

Commonwealth Institute of Biological Control,
Science Building, Carling Avenue,
Ottawa, Ontario, Canada
Director—W. R. Thompson, Ph.D., D.Sc., F.R.S., F.R.S. Can.
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